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THE AMERICAN JOURNAL OF ROENTGENOLOGY

VOL. IX [NEW SERIES] NOVEMBER, 1922 No. 11

FOREIGN BODIES IN THE BRONCHUS AND ESOPHAGUS*

BY CHAS. F. BOWEN, M.D.

COLUMBUS, OHIO

FOREIGN bodies have, I might say, always been more or less a hobby with me. My first serious endeavor along this line was described in a paper before this society, read at the Niagara meeting, in 1906, on the subject, "The Localization of Foreign Bodies in the Eye." This paper described a modification of Dr. Sweet's method of eye localization. The method is extensively used today, the apparatus being manufactured by Kelly-Koett and others. At the New York meeting, in 1908, a second paper told of the necessity of keeping the eye in a fixed position during the examination and described an apparatus for accomplishing this purpose.

At the same New York meeting a paper was read upon the subject, "The Localization and Removal of Foreign Bodies from the Extremities." A special fluoroscope was shown and the method of operating under direct fluoroscopic guidance was explained. This work led to my first "big case," where I removed a tack from the bronchus with a pair of hemostatic forceps, guided by the fluoroscope through a tracheotomy opening. The patient was twelve years old and had a temperature of 105°F. at time of the operation. The tack was removed in fifteen seconds from the time the room was darkened. This operation was performed on February 6, 1909, before I had heard of Dr. Jackson, or even knew that there was such a thing as a bronchoscope. This case was examined for supposed tuberculosis, and the tack found accidentally. Previous to this time I had removed so many needles and other metallic particles from the hands and feet, under fluoroscopic examination, that when I examined the chest plate and saw the tack I felt as though I should be able to take a pair of forceps and lift it right out. But how? I thought of opening the trachea and passing down a pair of forceps, and told of my plans to our leading surgeon, who answered, "Fools sometimes tread where angels fear to go." However, after several days of study and rehearsing, the tack was successfully removed, and the patient promptly recovered.

As far as I am able to learn, this was the first time that a foreign body had been removed from the lungs by a pair of forceps under fluoroscopic guidance. To sum up, a foreign body was removed from the lung for the first time by a new method in less than fifteen seconds. Why this success? Was it luck or something else? It was something else. I studied this case from every angle and rehearsed the operation with my assistants, as a stock company would rehearse for a new show. Remember this was a "first nighter" and the show just had to be a success. While the trachea was being opened in the operating room, I was waiting in the roentgen-ray room, with my eyes blindfolded. The patient was placed upon a table with the tube underneath. When everything was ready, the bright lights

*Read at the Twenty-second Annual Meeting of THE AMERICAN ROENTGEN RAY SOCIETY, Washington, D. C., Sept. 27–30, 1921.

were turned off and I removed the covering from my eyes. The forceps were placed in the tracheotomy opening and the room darkened. The tack was at once seen, grasped and removed. This was done so quickly that no one else saw the tack removed, for their eyes were not in condition. We were successful because we were thoroughly prepared.

attention to the early symptoms of a possible foreign body. In this way I have undoubtedly aided in making an early diagnosis, and thus prevented a fatal termination in a great many cases.

The roentgen ray plays a very important part in the diagnosis and is becoming more and more the "whole show" in the removal of foreign bodies. For this reason, I believe

FIG. 1. Round smooth foreign bodies in the esophagus can be removed by means of a pair of forceps, guided by the fluoroscope. If the patient is unable to swallow liquids, indicating that the mucous membrane has become swollen over the object, then the foreign body should be removed by direct observation, through the esophagoscope, perhaps guided by the fluoroscope.

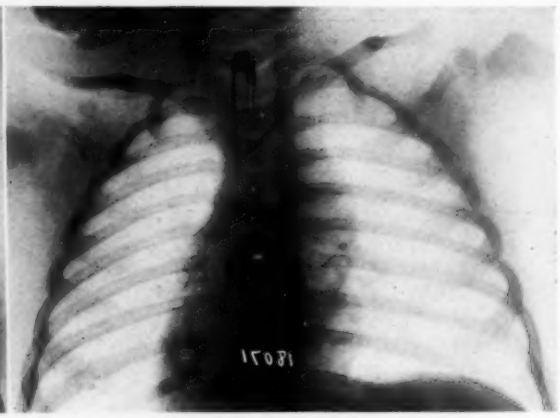

FIG. 2. Sharp foreign bodies, such as an open safety pin, should be removed only after a careful study by direct examination through the esophagoscope, to determine how much of the point is imbedded. The esophagus is easily torn, and great care must be used.

And now we have come to the first thought which I wish to present, i.e., "preparedness," or, I might say, preparation. I believe that any person of intelligence can master any subject if he will only concentrate and put his whole heart and soul into that subject.

Dr. Jackson is undoubtedly the leader in this work, and is certainly a genius. But what is a genius? Simply any ordinary human being of a little more than average intelligence, who has concentrated upon a single subject. Jackson cannot do all of this work, neither can the dozen or more men who are doing more or less of this work. These cases are much more common than generally supposed. My own records will show this. I have had a total of 386 cases, only 5 having come from outside of Ohio, the great majority of them coming from within a radius of fifty miles.

I have read papers and have called

that more roentgenologists should take up this work to relieve the shortage of skilled operators.

Following my first "big case," reported above, I had quite a series of foreign bodies in the esophagus, all successfully removed by means of forceps, under fluoroscopic examination. At the Detroit meeting, in 1910, I read a paper on the "Removal of Metallic Foreign Bodies from the Esophagus by Means of Forceps and Fluoroscope." In this paper, reports were made of 2 cases of open safety pins in the esophagus, with their points up, being successfully removed.

Following this meeting, I was invited by Dr. Jackson, who had heard of my work, to visit him at Pittsburgh. We discussed the advisability of combining the two methods, i.e., using the roentgen ray and the esophagoscope together. I worked this out, and at the Richmond meeting, in 1911,

FIG. 3. A bent safety pin, swallowed by an insane patient, was lying in the esophagus, with the point penetrating the posterior wall of the trachea. After a careful study of both views, the pin was removed in only a few seconds, without an anesthetic.

FIG. 4. A long bone in the esophagus. Foreign bodies in the upper part of the esophagus can best be shown by a lateral view, with the patient lying on the back without a pillow, with the chin high up and shoulders pulled down, making the neck as long as possible. The rays pass through the neck horizontally, while the plate is held at the side of the neck with sandbags. Usually the first eight vertebrae can be shown.

FIG. 5. Open beauty pin in the right main bronchus (no lung changes), removed without difficulty through the bronchoscope. The fluoroscope was at hand, but not used. Opaque objects in the bronchi can be differentiated from those in the esophagus by their position. They lie away from the middle line and usually at an angle, and point toward the trachea.

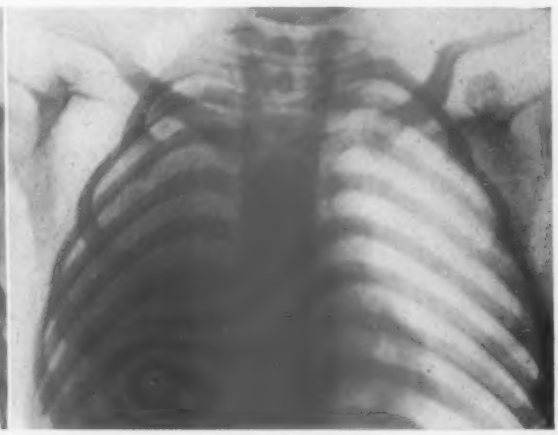

FIG 6. Metallic tip of lead pencil, with short piece of pencil completely plugging the left main bronchus with pent-up secretion. When the pencil was removed, the secretions flooded the lungs and prevented the author from seeing through the bronchoscope. The fluoroscope located the pencil in the opposite bronchus, from which place it was removed by means of a pair of forceps, passed through the bronchoscope, guided by the *x*-ray. Artificial respiration was used, with draining of the water-filled lung, and patient recovered. If both methods (*x*-ray and bronchoscope) had not been available, this patient would certainly have died.

I read a paper on the "Use of the Fluoroscope as an Aid to the Esophagoscope and Bronchoscope in the Removal of Foreign Bodies." Each method has its advantage in certain cases, but I do not believe that one is justified in attempting to remove a foreign body from the esophagus or bronchus by either method unless the other is immediately available. This has been proven so many times in my own experience that there is no need for discussion.

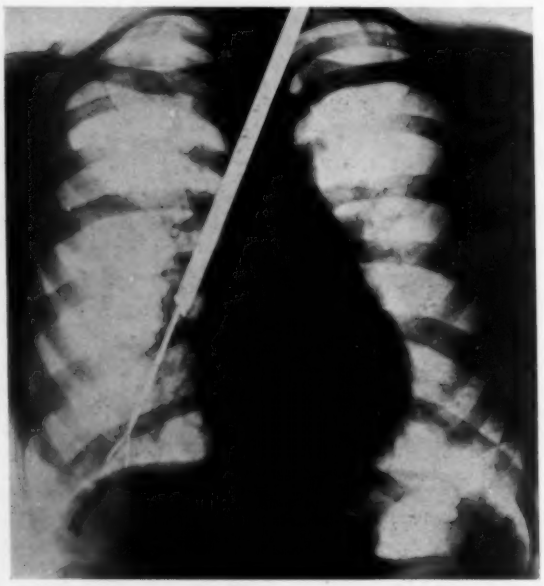

FIG. 7. Girl, aged nineteen, "swallowed" a beauty pin ten years before. Diagnosed tuberculosis, because of hemorrhages. Had been examined repeatedly with the fluoroscope, but nothing found. An x-ray plate showed the pin to be lying below the dome of the diaphragm, anteriorly. The bronchoscope was passed as far as possible, which was still six inches from the pin. A pair of forceps were then passed through the bronchoscope and guided toward the foreign body, by means of two fluoroscopes working at right angles. Pin removed in four minutes from time bronchoscope was passed. Hemorrhages ceased at once, and patient made prompt recovery.

The whole subject of foreign bodies in the bronchus and esophagus is a very interesting one, and I know of no branch of roentgenology which is so exacting and requires such painstaking work. You cannot just simply make a plate. The case must be really examined and studied. A plate of the neck may not show the foreign body; one of the chest, abdomen or pelvis may be necessary. But find the foreign body, unless you can state positively that none is present. Be sure, however, that the intestines did not move the foreign body around so fast that it did not show. I will never forget a case in which I gave a negative report, and the baby passed a safety pin four hours after my examination. A careful examination of the negative, which was given only four seconds' exposure, showed at least ten separate, but very faint, shadows of the safety pin over an area of about 4 in. in diameter. Or again, the pin which had been "swallowed," may have gone up in the posterior nares, instead of down, as was reported in one case. So in this work we must be sure, for there is no middle ground. The child either has or has not a foreign body. You are either right or wrong. Just imagine that the little patient is your child, and make a thorough study. These patients cannot be run through the laboratory like fracture cases. Really examine your patient and then rely upon the sense of fairness of the operating surgeon to see that you are compensated for your work.

From the standpoint of the roentgenologist, foreign bodies can be divided into three classes:

1. Those which are plainly "visible," as a nickel in the esophagus or tack in the lung.
2. Those which are not opaque but are "visible" by indirect methods, as a grain of corn in the bronchus, by the lung changes, and a bone low in the esophagus by a barium meal.
3. Those which are not opaque and cannot be located by indirect methods.

The first class of cases, i.e., those which are opaque and show plainly, needs no particular comment, as far as diagnosis is concerned, except that it is always necessary to get a plate of sufficient clearness to show a foreign body if one should be present. Sufficient penetration must be used to go through the mediastinum and other thick structures. Only recently I saw a case in which a large beauty pin in the lung had been overlooked, once by roentgenographic and three times by fluoroscopic examination, by different men. The pin was lying below the dome of the diaphragm and sufficient penetration had not been used to pass through the liver.

It is sometimes difficult to tell whether the foreign body is in the esophagus or trachea, from a single plate. A lateral view will, as a rule, give at once the exact location. Again, it is at times extremely difficult to tell whether a foreign body is lying in the stomach or the intestines, especially in the transverse colon. If, however, the shadow is well below the diaphragm, its exact location is not at all necessary,

unless the symptoms are urgent, for they are seldom removed. Heavy foods, as bread or potatoes, can be given, but no physic.

If the foreign body is in the esophagus it can be easily removed by means of forceps and fluoroscope, if it is smooth and not imbedded; otherwise, it had better be removed by means of the esophagoscope, guided by means of the fluoroscope. It is not always necessary actually to use the roentgen ray, but it should always be at hand. If the foreign body cannot be located at once, with the esophagoscope, the reason should be determined fluoroscopically. The foreign body may have passed on into the stomach or may have been overlooked and the esophagoscope slid past it. The roentgen ray will answer the question and should be at hand.

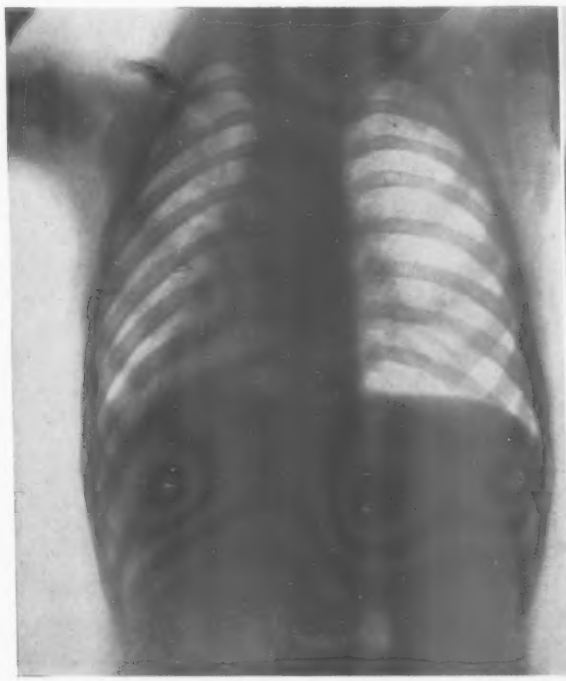

FIG. 8. Non-opaque foreign body: peanut. Roentgenogram is typical of a foreign body blocking the bronchus. The diaphragm on the affected side is flattened; the entire mediastinum is pushed over to the opposite side and the lung contains an excess of air. No other lung change. One rather large piece of peanut was removed by the author, from the right bronchus, in this case.

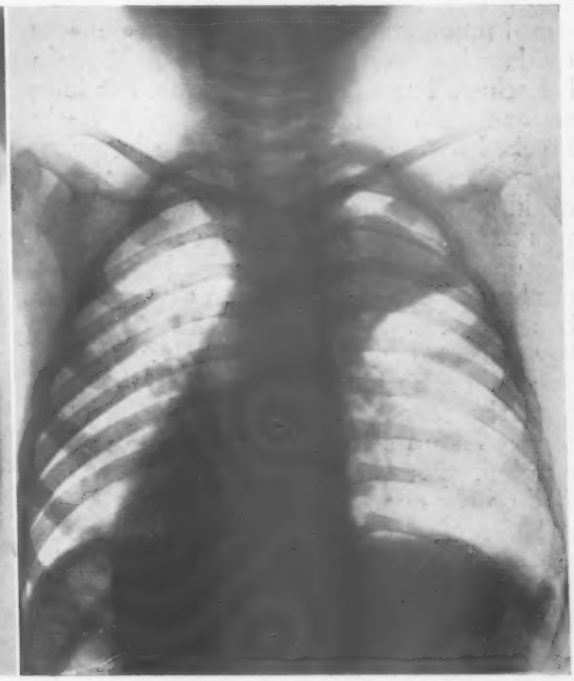

FIG. 9. Forty-eight hours after inspiring peanut candy, upper right lobe consolidated; only slight obstruction to passage of air to rest of lung, as shown by slight emphysema and slight flattening of diaphragm on right side. Temperature 102, pulse 110, respiration 80. Eleven small pieces of peanut were removed from upper right lobe bronchus. Recovery.

Foreign bodies in the trachea or bronchi must of necessity be removed through the bronchoscope, but the roentgen ray must be a part of the operating table and must be connected ready for instant use. I have seen its advantages so many times that I would make no exception. A small screw was located in the left main bronchus. The child struggled terribly while going under the anesthetic. The bronchoscope was passed to the location of the screw, but it had moved. I could have located it with the bronchoscope, but why take the time? The fluoroscope was used at once and the screw found to be lying about 2½ inches farther down in one of the smaller bronchi. A pair of forceps was passed through the bronchoscope and the screw grasped by the forceps with the aid of the roentgen rays, 2½ inches beyond the end of the bronchoscope. The entire operation did not require over four minutes.

I will now cite a case in which the child would certainly have died on the table had it not been for the roentgen rays. A boy, aged twelve years, had inspired a piece of lead pencil, with its brass tip. The pencil was so short, that of the pencil proper there was just a conical point projecting from the brass end. This had entered the left bronchus and acted as a plug, back of which the secretions had accumulated. The entire lung being water-logged, cast a uniformly dense shadow on the plate. The child was very ill. The bronchoscope was

passed, the brass end located, and at once grasped with the forceps and traction made. The forceps slipped off and there was a gush of fluid which literally drowned the patient. I had loosened the pencil and allowed the pent-up secretions to escape. The child stopped breathing, for he was literally drowning. I could not see through the bronchoscope because of the secretion, which now was running out of the end of the bronchoscope. The fluoroscope was used and the pencil found in the right main bronchus. The situation was this: left lung water-logged and right lung completely blocked with a foreign body; the bronchoscope was so filled with secretions that I could not see through it. A pair of forceps was passed through the bronchoscope and the pencil grasped while watching it with the fluoroscope. Time of operation not over five minutes. Artificial respiration for a few minutes and the child was again breathing. Had it not been for the fact that the roentgen-ray apparatus was all connected up and tested, with the motor running, this child would certainly have died on the operating table.

The second clas consists of those which are not opaque but are "visible," by indirect methods. Non-opaque foreign bodies in the lung are very common and at times very hard to diagnose positively. If the foreign body has been present for some time, changes in the lung itself will be noted. An abscess or a pneumonic process will give a clew.

However, it is the early cases which are the most difficult. The history of the child choking should put you on your guard to be on the lookout for early lung changes. These children, as a rule, are hard to roentgenograph. Several plates of the chest should be made with as short an exposure as possible. A flattening of the diaphragm, a displacement of the mediastinal shadow or a darkening of the lung is usually positive proof that a foreign body is blocking the bronchus on that side.

In these non-opaque cases the services of the roentgenologist end with the making of the diagnosis, for the bodies all have to be removed by the direct method through the bronchoscope. These cases are all serious, and if there is the slightest doubt as to the diagnosis, I invariably pass the bronchoscope and make a thorough search.

Non-opaque foreign bodies in the esophagus can be located by watching the passage through the esophagus of a rather heavy barium meal, or a barium capsule. The esophagoscope, of course, must be used to remove the obstruction.

The third class, those which are not opaque and which are not visible, comprise a rather small group and need not concern you. Remember, however, that if you are unable to locate a foreign body, either by the direct or indirect method, there may still be one present, which is not opaque or has not as yet produced changes. Make your report read: "I see no shadows or conditions present which would lead me to suspect a foreign body, but I do not say positively that there is none present."

DISCUSSION

DR. MANGES. I would, of course, refrain from any technical discussion so far as bronchoscopy is concerned. First, as to the fluoroscopic control of removal of foreign bodies, Dr. Grier, some years ago, published a paper in which he described an apparatus where the control was by means of two fluoroscopes at right angles. If you are going to use fluoroscopic control for the direction of your forceps, then you should by all means use two fluoroscopes and two screens, one at right angles to the other. I have had considerable experience in this work. I have helped Dr. Jackson through some exceedingly difficult problems, and our experience has been that with one screen alone it is difficult to tell whether you are in front or in back of the foreign body. You want to do as little damage to the lung tissue as possible. Dr. Jackson is insistent on extremely careful localization before he attempts to remove any foreign body. I feel that we, as roentgenologists, ought to perfect our technique in this matter of localization and that we should perfect our knowledge, as nearly as possible, in the minute details of the anatomy of the lung, that is, to know where the main bronchi are, or even study the location of the vessels.

Those of you who have seen Dr. Jackson work know that it does not make a bit of difference what the foreign body is; he always prepares for anything that might happen. He has all his instruments out, no matter what he is going to do, and it is with the utmost care that he selects his instrument. He used to get a great many cases fairly early after aspiration.

He does not get as many now, and it shows there are many men doing this work. The fact that many more men are doing this work is positive proof of the reiterated assertion that there are many more of these foreign body cases than we ever suspected.

Foreign bodies are apt to move. It was thought that a jackstone would not move after it got stuck in the esophagus. We had one recently that did move. Almost immediately after Dr. Jackson attempted to remove it, we found the jackstone in the abdomen. So even a jackstone may pass. You must not assume anything. Go to the utmost length to prove it. Here is another lesson with regard to careless localization. This case came to our laboratory one day: A baby that had been in another hospital in Philadelphia, down on the table under a general anesthetic for over an hour while the bronchoscopist attempted to remove a safety pin from the bronchus. He failed to find it. They rushed the child down to Jefferson Hospital expecting Jackson to start right in and find the safety pin. He said in his quiet way, "Send it down to Manges and see what he has to say." The child was sent to me. I put the child on the fluoroscope table and the safety pin was in the abdomen. It had not been in the bronchus at all. That child almost lost its life from careless localization.

I think Dr. Bowen is deserving of the utmost congratulation and of the greatest encouragement in his work. But I doubt, honestly, whether there are very many of us, as roentgenologists, who are really fitted or capable temperamentally, mechanically, and in other ways to undertake a work like this. My own feeling is that, inasmuch as Dr. Jackson is so eager to spread his knowledge and teach others how to do it, we ought not to interfere. We ought to encourage it. I think, as roentgenologists, we ought to keep out of the field. On the other hand, Dr. Bowen ought to keep up his good work.

Dr. Hickey. I had the pleasure of watching Dr. Bowen work and congratulate him on the progress he has made. With regard to removal of foreign bodies under fluoroscopic control, I think a word of warning should be said; and that is, unless you are very expert with the method, the forceps should be passed into the esophagus or passed into the trachea under direct inspection of your bronchoscope, because unless you are experienced and know the anatomy of the throat so that you can visualize things which you cannot see, you should not attempt to push the forceps down without this precaution. It is very easy to slip a bronchoscope into position and see your opening into the esophagus and introduce your forceps. The same way with the trachea; once your forceps are in the trachea, then you can pass down and you are not able to do any particular damage. But unless the head is in proper position and unless the forceps are guided, you are apt to traumatize the lower pharynx.

Every case should be rayed, no matter how clear the history is. There was a child brought into the hospital and the father said it was choking from a burnt match. They said it was not necessary to ray it, as wood would not show. However, we did ray it and found it was a nail instead of a match. It is best not to take for granted that your foreign body will not show, but to ray all cases.

With regard to Manges' statement about misinterpretation of roentgenograms, this came forcibly to my mind not long ago: I was called to go to the hospital to see a child. A tracheotomy was done looking for a safety pin, but it could not be found. I asked to see the plates. I said the safety pin was not in the trachea but was in the esophagus, because you could tell the way it lay with the longest dimension laterally, expanding in the direction of least resistance in the esophagus.

A recent case, which is somewhat unique, illustrates the direct value of fluoroscopy. A boy, about eight years old, was taken with severe hemorrhage after a tonsillectomy. The nose and throat man attending the case started to sew up the pillars and broke his needle. The case was brought to the hospital, and the doctor who lost the needle was very anxious to have it recovered because it would be much easier to explain to the parents. One or two of the nose and throat men searched for the needle for some time. I suggested that they bring him to the fluoroscope room if they wanted to find the needle. After a little reluctance they brought him down. We used the oil immersed unit which we use for reducing fractures. The child was placed on his side; the forceps introduced into the mouth, watched until it came above the needle, then the forceps were closed and the needle removed. A roentgenogram did not help in that case, because there were no landmarks in the mouth. I wish to compliment Dr. Bowen on his work and on the fact that he gets down to rock-bottom facts without many preliminary remarks.

Dr. Gray. In this connection I want to enter a plea for fluoroscopic control of esophageal dilatation. It was recently impressed upon me most forcibly that we are entirely too prone to make a diagnosis of cardiospasm. The case is referred to a man who is going to do

dilatation, whether he be a gastro-enterologist, bronchoscopist, or surgeon, and that is the end of it. He either succeeds or he fails.

Not only as a caution is it advisable to use the fluoroscope, but quite frequently, particularly in ill-proportionate individuals is it difficult to tell whether or not the tip of the dilator is through and whether or not you have the rubber bag in proper position to dilate the cardia.

In quite a number of cases I have been able to assist the surgeon in that way. It is very necessary, particularly in these cases of greatly dilated esophagus, especially when the dilatation extends to the right.

Dr. Dunham. I believe, in dealing with localization of these foreign bodies in the lung, much benefit can be had by knowing the anatomy of your bronchi. This does not mean that you can do away with any of the refinements which have been so definitely spoken of with reference to the plate or fluoroscope, but above all judgment should be used in the handling of any of these cases. I believe, if there was one thing Dr. Bowen brought most to your knowledge, it was judgment with complete preparation. Sometimes, especially in older people where they are able to hold still and the foreign body has been there for a long while, it is possible to get very good stereoscopic plates. By those plates you can localize the various bronchi. It has been a long discussion as to whether the line markings in the chest are the result of bronchi or veins. That is purely an academic question. Again, the fundamental thing to remember is that in every one of those trunks leading from the hila of the lung you have bronchi, and by following the bronchi you have your localization. You can, therefore, tell which bronchi are going to the middle, upper, or lower lobe on the right side. You can often tell whether you have abnormal lobation in the lung. It is often possible accurately to localize the lobe and tell whether the foreign body is anterior or posterior, by giving careful study to the localization of the bronchi near which the foreign body is located.

Dr. Bowen (closing). I wish to thank the members for their kind discussion of this paper. I did not have time to go into it very thoroughly and could not describe the apparatus. I always use two fluoroscopes and have them ready to use in either way. My two assistants can use the fluoroscope while I am doing bronchoscopic work.

It was Jackson who urged me to take up bronchoscopic work.

We must remember that every case of foreign body is a case by itself and must be studied thoroughly and a scheme worked out for that individual case.

THE ROENTGENOLOGICAL STUDY OF THE PATHOLOGICAL GALL-BLADDER*

BY B. R. KIRKLIN, M.D.

MUNCIE, INDIANA

IT is with considerable timidity that I attempt to discuss the roentgenological study of the gall-bladder before this society, for I realize that during the past few years this subject has caused a great deal of criticism, and that there has been more or less of a controversy regarding its real value. So many roentgenologists throughout the country have not had the interest to do this work, or if they have, it seems that little effort has been made toward a progressive study of the gall-bladder, or developing a careful and correct technique.

FIG. 1*a*. Case 3311A. Visualized gall-bladder showing one gall-stone shadow.

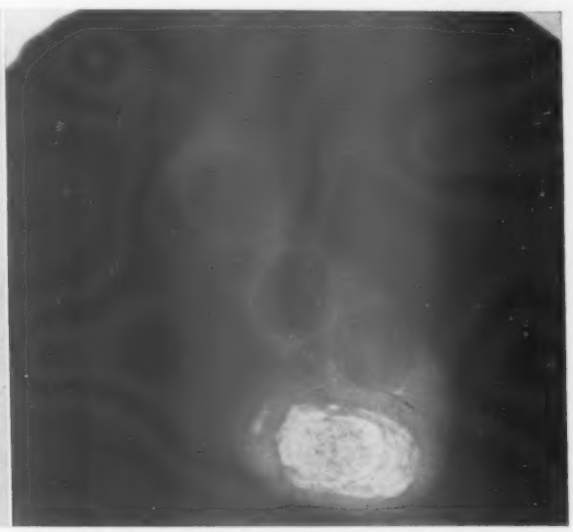

FIG. 1*b*. Case 3311B. Roentgenogram of removed gall-bladder showing the one stone which casts a positive shadow, and seven stones which cast negative shadows.

It is our opinion that most of the men who are attempting to do gall-bladder *x*-ray work are merely searching for gall-stones instead of carefully searching for any direct or indirect evidence of gall-bladder pathology other than the mere presence of stones.

A great many men are still of the opinion that they are wasting time and material in searching for gall-bladder pathology, and when they do go after a gall-bladder they do it in a half-hearted way, doubting if they will find any pathology, even though it be there. It is our opinion that unless a man attempts this work carefully, believes in its merits and is confident that his investigation is thorough, he had better not try it at all.

GALL-STONES

The question of gall-stones is of very small moment, for we all know that there is a large number of stones which offer no density, not even as much as the bile in which they are contained, which, in fact, may cast negative shadows. Again, George has called our attention to the fact that, though the stones individually cast no positive shadow on the *x*-ray film, and offer very little anatomic weight, yet,

* Read at the Midwinter Meeting of the Central Section of THE AMERICAN ROENTGEN RAY SOCIETY, Chicago, Ill., February 22, 1922.

en masse, they assume a certain amount of density, which together with the changes in the gall-bladder wall, produces a characteristic shadow easily recognized with reasonably good technique.

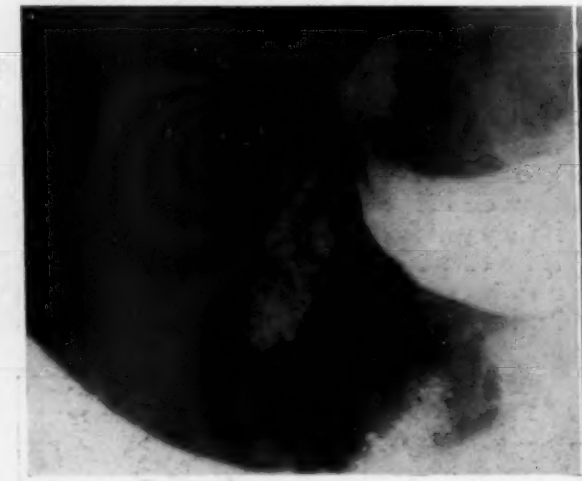

FIG. 2*a*. Case 3415A. Pathological gall-bladder filled with very dense stones. Referred for roentgenological examination of left kidney. All symptoms on left side.

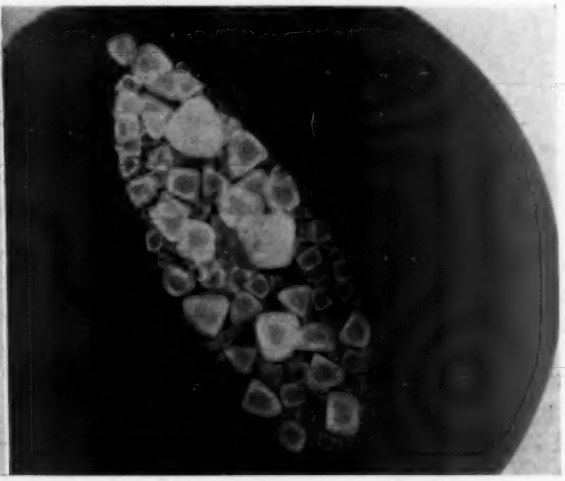

FIG. 2*b*. Case 3415B. Roentgenogram of gall-bladder after its removal.

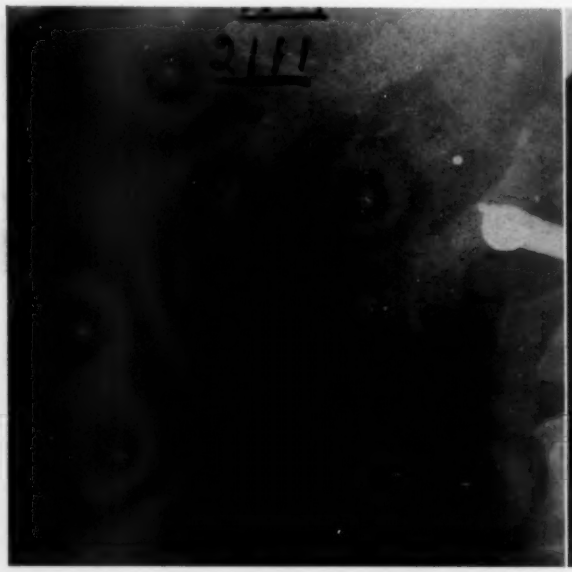

FIG. 3*a*. Case 2111A. Enlarged, pathological gall-bladder with stones.

FIG. 3*b*. Case 2111B. Roentgenogram of gall-bladder after removal.

THE GALL-BLADDER SHADOW

The question is often asked, "How do you make a positive *x*-ray diagnosis of gall-bladder pathology?" In the first place, we look for a *gall-bladder* shadow. The normal gall-bladder under ordinary routine conditions, is not visualized. There may be a rare exception to this rule, but for all practical purposes, we may say we are unable to visualize the normal, healthy gall-bladder. The above opinion is held by George, who probably has done more successful gall-bladder work than any other roentgenologist. If we agree on a

shadow that must represent definitely, by its size, shape and location, the gall-bladder, and which shows readily on the ducts, in varying size, density and amounts. Any of the above factors, singly or collectively, will offer a fairly dense and

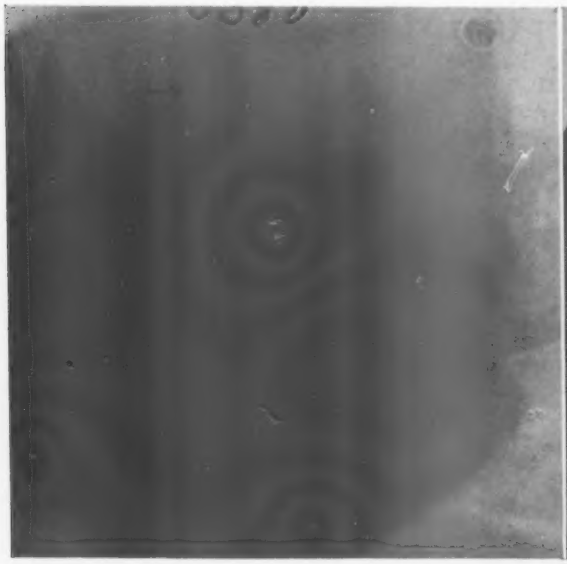

FIG. 4*a*. Case 3380A. Pathological gall-bladder. No stone shadows seen.

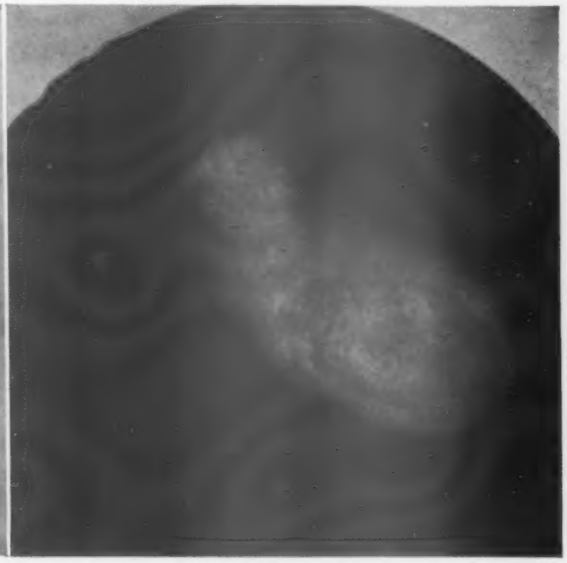

FIG. 4*b*. Case 3380B. Roentgenogram of gall-bladder after its removal, showing two large gall-stones which did not show on roentgen examination. Part of one casts a negative shadow. This case illustrates the importance of examining plates and films for gall-bladder shadows rather than for gall-stone shadows.

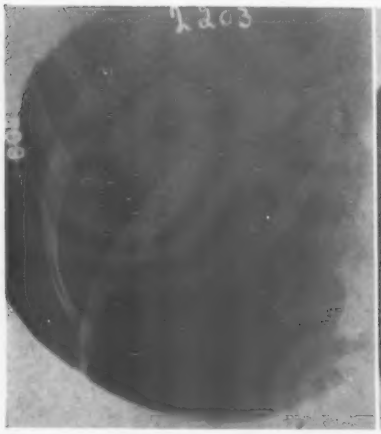

FIG. 5*a*. Case 2203. Pathological, distended gall-bladder with stones.

FIG. 5*b*. Case 3738. Pathological, distended gall-bladder, filled with very small stones.

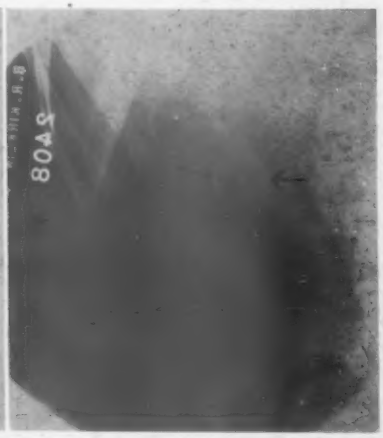

FIG. 5*c*. Case 2408. Pathological gall-bladder with a large gall-stone. This patient was referred in for roentgenological examination of left kidney. Symptoms all on left side.

roentgen-ray film, this gall-bladder must be pathological. Either it is enlarged, its walls are thickened, the bile is darker in color (which means increased density) or there are stones in the gall-bladder or easily recognized shadow with carefully developed technique.

Any shadow which we can interpret as representing a gall-bladder leads us very definitely to the opinion that it must

represent pathology in some degree or form within or about the gall-bladder, with or without stones, *and is so reported.*

INDIRECT EVIDENCE

We should go further in our investigations, however, than merely looking for a positive gall-bladder or gall-stone shadow. has been found that a gall-bladder, besides being easily visualized, may show pressure of itself upon the duodenum or antrum of the stomach; or possibly produce displacement, if it is large enough, of the jejunum, and especially of the colon, in the right upper quadrant; or again, cause a deformity of the first portion of the

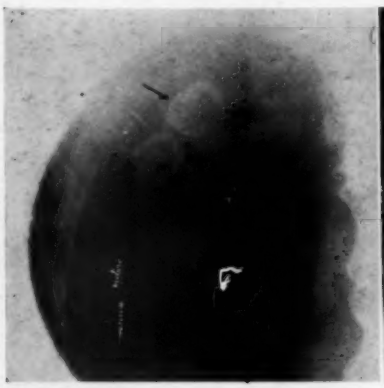

FIG. 6*a*. Case 2794. Pathological gall-bladder with two large calcareous gall-stones.

FIG. 6*b*. Case 1883. Pathological gall-bladder filled with stones and adhesions picking up hepatic flexure of colon.

FIG. 6*c*. Case 4518. Pathological gall-bladder with stones. Note the negative gall-stone shadow at A.

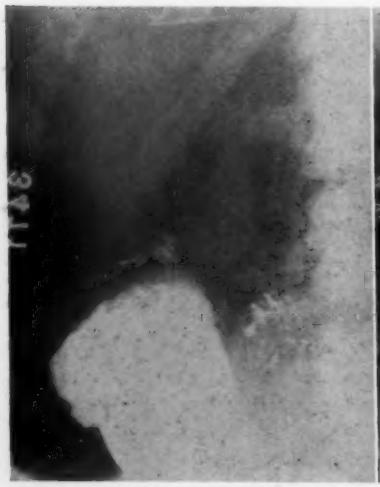

FIG. 7*a*. Case 3471. Pathological gall-bladder with stone and adhesions involving second portion of duodenum with resulting distention of duodenum proximal to adhesions.

FIG. 7*b*. Case 1416. Distended, pathological gall-bladder with stone. Note pressure of distended gall-bladder against stomach.

FIG. 7*c*. Case 4925. Pathological gall-bladder filled with sand. Note adhesions between gall-bladder and stomach.

Even if no gall-bladder or gall-stone shadows are discovered, there are a number of roentgen-ray findings following a barium meal which are of invaluable assistance in arriving at a roentgenological diagnosis of gall-bladder pathology. It duodenum due to adhesions and picking up of the second portion, pulling it over to the right and outlining the gall-bladder; or it may cause hepato-fixation of the stomach due to pericholecystitis with adhesions, or produce deformities of the

hepatic flexure. The emptying time of the stomach following a barium meal is usually much shortened with gall-bladder pathology present.

SURGICAL REPORTS

We do not believe that the roentgenological evidence or any other evidence of gall-bladder pathology should be considered wrong until the accused gall-bladder has, at least, been opened, or better still, has been removed and submitted for pathological examination. We have known of a few cases where gall-bladders have been palpated at operation and pronounced normal in spite of the fact that the roentgen-ray examination showed evidence of shadows which were interpreted as gall-stones. The surgeon was persuaded, however, in these cases, to open the gall-bladder, and gall-stones were found.

FIG. 8a. Case 1194. Upper shadow is stone in cystic duct; nine shadows represent nine gall-stones found in fundus of gall-bladder; below is seen the shadow of a pathological adherent appendix.

FIG. 8b. Case 3540. Showing pressure of distended gall-bladder against stomach.

FIG. 8c. Case 2808. Pathological gall-bladder with dense adhesions between gall-bladder and stomach.

FIG 9a. Case 3419A. Visualized, distended gall-bladder.

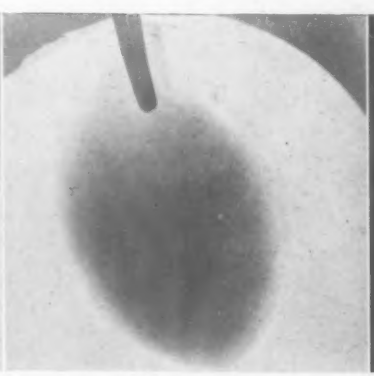

FIG. 9b. Case 3419B. Roentgenogram of gall-bladder after its removal.

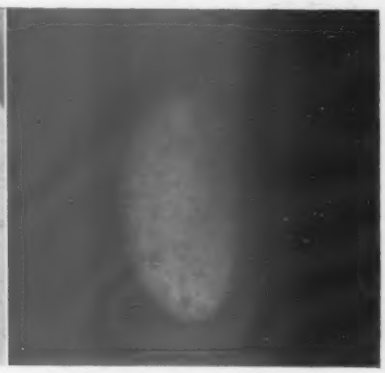

FIG. 9c. Case 2047. Roentgenogram of removed gall-bladder of patient on whom we made a negative roentgenological report. Note the many small negative gall-stone shadows throughout the gall-bladder.

TECHNIQUE

The patient is instructed to take two drams of compound licorice powders each night for two or three nights previous

to the examination, and to eat no evening meal the day previous and no breakfast on the morning of the examination. We first make from two to four exposures of the gall-bladder region (including all the area between the crest of the ilium and tenth rib), varying the penetration, time, etc. but being careful that the dark-room assistant develops all the films for the same length of time, thereby insuring films of varying densities. The above preparation and examination is made on every patient examined for any abdominal condition. We then give a barium meal in the fluoroscopic room and search carefully for any indirect signs, which have already been enumerated. We then make more gall-bladder exposures in order to pick up any adhesions or pressure involving the stomach and duodenum, or any other findings that might have been missed on our first series of films. The hepatic flexure of the colon is studied at eighteen to twenty-four hours.

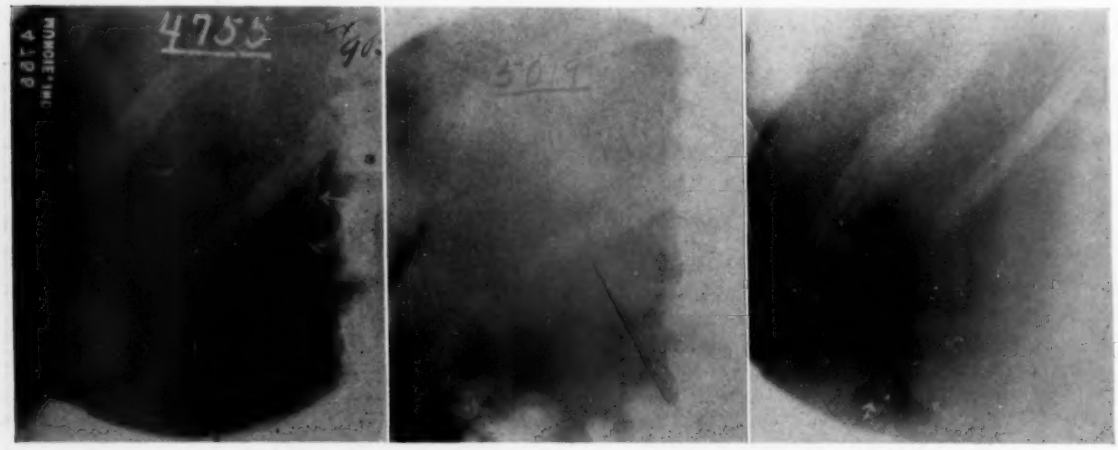

FIG. 10*a*. Case 4755. Visualized, pathological gall-bladder.

FIG. 10*b*. Case 5019. Visualized, pathological gall-bladder.

FIG. 10*c*. Case 4052. Visualized, pathological gall-bladder. Note low position of gall-bladder.

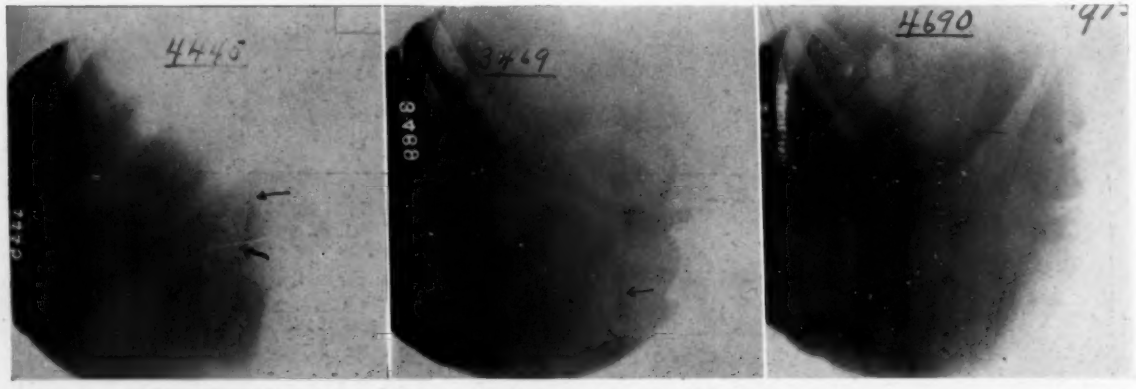

FIG. 11*a*. Case 4445. Visualized, pathological gall-bladder.

FIG. 11*b*. Case 3469. Visualized, pathological gall-bladder. Note low position of gall-bladder.

FIG. 11*c*. Case 4690. Visualized, pathological gall-bladder.

A good gall-bladder plate or film should show a wealth of detail of soft structures, and one of the most important factors is the *absolute* stillness of the patient during the exposures. The Potter-Bucky diaphragm and double screens have been very valuable assets in this work and have made possible the obtaining of films of still finer quality than before.

We attempt to impress on the referring physician that we also need his clinical help, and I think that we, as roentgenolo-

gists, should consider ourselves as medical consultants and require a complete clinical history in every case. If such a history does not accompany our patients, we take a history in the course of our examination, so that this may be consulted, as well as our roentgen-ray findings, in arriving at our final conclusions.

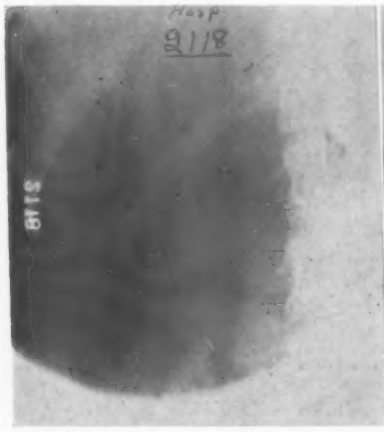

FIG. 12a. Case 2118. Visualized, pathological gall-bladder.

FIG. 12b. Case 3468. Visualized, pathological gall-bladder.

FIG. 12c. Case 3436. Visualized, pathological gall-bladder.

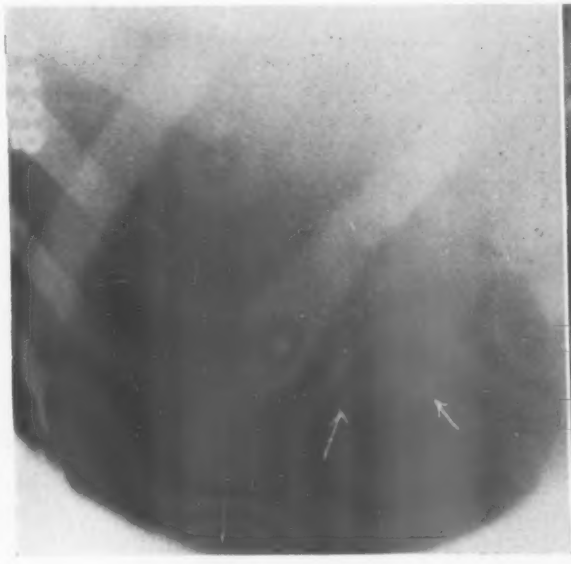

FIG. 13a. Case 3435. Visualized, pathological gall-bladder.

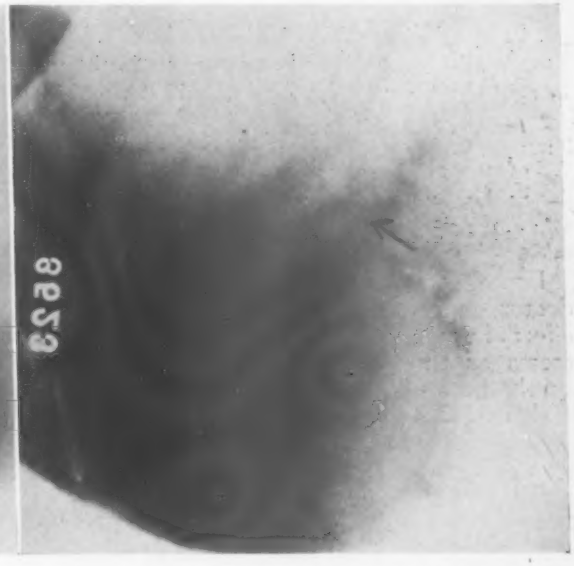

FIG. 13b. Case 3523. Visualized, distended gall-bladder.

STATISTICS

During the past twenty-eight months we have made a complete roentgenological gall-bladder study of 712 patients. We reported "Roentgen-ray evidence of gall-bladder pathology, with or without stones" in 251 cases, which is approximately 35 per cent of the total number of cases studied. We have been able to obtain the operative findings reported in 214 of these cases. The surgeons reported that the gall-bladder was normal to palpation in 7 of the cases in which we had reported positive roentgenological findings, and in 6 of the cases in which we had reported negative roentgenological findings, the surgeons reported gall-bladder pathology of some

form. In other words, our roentgen-ray conclusions were confirmed in all but 14 cases, or approximately 93½ per cent.

Of course, the above represents a very small series of cases, but it also represents the reason why we have such firm convictions concerning this subject.

CONCLUSIONS

A careful roentgenological investigation should be made of the gall-bladder region of *every* case that is referred for abdominal study. We feel confident that if every competent roentgenologist will develop a careful technique and make a thorough routine search for gall-bladder pathology in every one of his gastrointestinal and other abdominal studies, the statistics reported so far will soon be more generally accepted, and no doubt improved upon.

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DISCUSSION

DR. COLE. I want to congratulate the doctor on his presentation and especially his efforts in making up such a percentage that it seems as though it might be overstated. I think, however, that we should give this a little more time and I think if we do that many of you will come to the same conclusion that we have. Our success has been so good that in every gastrointestinal case we take at least two gall-bladder plates with very rare exception and we are often astonished at what we find.

I think two things must be kept in mind; one is that you must use good technique. Get good plates; if you do not, in the majority of cases, they are worthless. Second, study the plates, and learn how to interpret them. I think the interpretation of gall-bladder plates is difficult. It is astonishing how you can go back after operation when you know that stones were found, examine your plates, and see the stones. We had a case in which we reported to the surgeon that we were not certain about the presence of gall-stones, but it looked suspicious. He operated and found gall-stones and we were then able to see the stones perfectly. That showed that we had not studied our plates carefully enough. It is necessary to get the plates at the right angle and spend a good deal of time to interpret gall-stone plates properly.

As to the Bucky diaphragm, we have not been very successful with it in finding stones. It seems to me there is so great a wealth of shadows that it is confusing. I know of no other way to describe it except to say there are too many shadows on the plates. At present I prefer the double screen, and moderately fast exposure. I think we find more stones with a back-up of 3½ inches than we do with 5 inches.

DR. UPSON. I think this paper is very interesting and timely. While there are a number of things that occupy the center of the stage just now, this is something we have to do every day.

In speaking of these indirect evidences, I wonder how long it will be before we can consider them positive evidences. I suppose you all have the same trouble that we do, namely, that it is a little hard to convince the internist and sometimes the surgeon that these evidences are of sufficient importance for them to take seriously. In a series of cases we watched two or three years ago our percentage of indirect evidence was about 83 that proved to be positive at operation, a little less than those that have been reported today; but I believe that the time is coming when indirect evidences will be important enough for the internist or the surgeon to consider seriously. I think that in our reporting we should be a little more positive than we have been and insist on our reports being taken a little more seriously.

Another point: In the doctor's paper he spoke of two shadows being looked for in discovering the shadow of the gall-bladder. I believe you should look for three,—the shadow of the liver, the shadow of the right kidney, and over that a third shadow, which soulhd be regarded as the gall-bladder. We attempt in our cases, if we are depending on the shadow of the gall-bladder, to detect these three shadows. I believe that in detecting gall-bladder disease, the evidences shown on the pylorus and duodenum are of equal importance with the shadow of the gall-bladder. I believe these should be watched for in the fluoroscopic room as well as on the plates.

DR. EVANS. Some five or six years ago in Detroit, Dr. Reu gave a very fine paper on gall-bladder pathology. He showed that reverse

peristalsis was an important finding in gall-bladder work.

Dr. Beeler. I would like to ask Dr. Kirklin if there is any way of differentiating between the kidney shadow and the gall-bladder shadow. Often you get a kidney shadow that resembles the gall-bladder. I have had a few cases with such shadows where operation showed a normal right upper quadrant. Has he any way of differentiating between the two?

Dr. Dachtler. I would like to ask Dr. Kirklin about reverse peristalsis, lagging of the duodenum and the differentiation of gall-bladder conditions from pathology at the duodeno-jejunal junction. I think perhaps those cases are a little more common than we were led to think in the past.

Dr. Crane. I want to put myself on record as not being able to find over 10 per cent of gall-stones on any of my plates. I have been very much interested in this subject; we have taken plates with double screen and without screen, we have examined our plates with the reducing lens and through opera glasses the wrong way and the right way, and we have found the shadow of the gall-stone in only about 10 per cent of the plates. I think in certain cases we have had very good plates. We have made a practice of taking serial plates. We have arrangements whereby we can take four views on a 10 × 12 plate in the region of the gall-bladder. You can take a number of these plates and get two or three views of the gall-bladder. Two or three views are all that is necessary in fleshy women over 40, where if you get gall-stones every time, you are right in at least 60 per cent of the cases. I think you can often tell in fleshy people, when you see the shadow of the right kidney, if there is a definite dark line, a rather narrow line, that it is the perinephritic fat, the fatty capsule of the kidney, which has about 7/10 the density of the kidney. It leaves a dark margin which gives you a fair outline of the lower pole of the kidney. To my mind, there is nothing that has thrown so much discredit on the roentgenologic diagnosis among surgeons and internists as the attempted diagnosis of gall-stones and gall-bladder disease. I heard Dr. George say he could find 90 per cent gall-stones. I went home feeling very humble indeed. I am sure that 10 per cent is a liberal allowance for all stones we can see on plates that we are sure are gall-stones. We can have opinions sometimes that are best not expressed except to our intimate friends.

Dr. Potter. The question of using the grid for gall-bladder outline is like this: The grid gives an increase in contrast but because of the increased distance of the patient to film you lose some line detail, especially because of the way the grids are built. What we want in locating the outline is to find the dark line that marks the edge of the gall-bladder. All other technique is aimed at getting that clue. It helps in recognizing the gall-bladder with a grid that is built with a great space between film and patient. However, with gall-stones, what you are aiming at is to recognize a change in density, and you can get that better with a grid.

Dr. Hickey. I would like to ask the doctor to summarize his technique.

Dr. Arens. I would like to add a few remarks to what Dr. Kirklin has said, and I want to congratulate him on correctly diagnosing such a high percentage of pathological gall-bladders, both with and without stones. In our series we found 85 per cent, combining both roentgenography and fluoroscopy. We found one fluoroscopic sign that seemed to be almost pathognomonic of a pathological gall-bladder, and that was the presence of a duodenal stasis with regurgitation. Several other conditions may cause this phenomenon, namely, an appendix, colitis, ulcer, arterio-mesenteric occlusion, duodenal obstruction, etc. Ruling out these conditions leaves practically nothing else to account for this so-called duodenal stasis and dilatation except a pathological gall-bladder. I have checked this up in a large number of cases, and the percentage is high, making the check-up against the plate shadows and the operating table. I wonder how much stress Dr. Kirklin lays upon it. A year ago he called attention to duodenal lagging in gall-bladder disease, but he had reference to the bulbus duodeni, whereas my findings are beyond this point. I wonder whether he is still paying attention to this point and whether he still considers it as distinct evidence of gall-bladder disease.

One other item about studying plates. To me, studying gall-bladder plates consists of not only an accurate knowledge of the pathology present, but also using the proper method of illuminating those plates. I have a number of plates in which I can wipe out the shadow of the gall-bladder by intense light. By reducing the brilliance of the light by means of a rheostat it is possible to bring out the gall-bladder shadow clearly. I think proper lighting has a great deal to do with the correct interpretation of the plates.

Another point in conjunction with the Bucky diaphragm and double screen plates: I have personally not used the Bucky diaphragm extensively for gall-bladder work, and I do not

want to go on record by saying that the Bucky diaphragm is not a good thing to use, but the fact remains that some of our poorest plates, in almost every case, will show the gall-bladder, while the best plates, technically speaking, do not show it. It seems to me to be entirely a matter of the proper penetration, i.e., quality of the *x*-rays used.

DR. KIRKLIN (closing discussion). I want to thank these gentlemen for their very liberal discussion. It is very gratifying.

Emphasizing what Dr. Cole has said regarding looking over old plates, we have had the same experience. Another thing that I think should be emphasized is a very conservative report.

In speaking of the kidney shadows which Dr. Upson and Dr. Beeler mentioned, we always make sure that we can outline our kidney before we look for the gall-bladder, and so there is no danger of mistaking that kidney shadow for the gall-bladder shadow. We always want to be sure that we can definitely outline the kidney shadow first. Usually the gall-bladder shows superimposed upon the kidney shadow. Another thing to be remembered is that we are making the exposure posteroanteriorly, and the kidney is spread out over a large area, which makes it better for interpreting the gall-bladder shadow through it.

Regarding technique, our technique of course consists in the first place in the proper preparation of the patient. We instruct the physician to give the patient compound licorice powder for two or three nights previous to examination. We are able to eliminate gas with compound licorice powder better than with other cathartics. We have the patient eat a light supper and no breakfast the morning of the examination. We make two to four gall-bladder exposures, using various techniques, depending on the size of the patient. It varies from 3 to 4½ in. spark gap with a distance of 22 in. We started out that way and have never changed. It may be that a greater distance will give better results, but that is the distance we use at present for gall-bladder work. We do not give any two plates the same exposure. We vary the exposure from 2 to 5 seconds. The dark room assistant is instructed to place all the films in the developing solution at the same time and take them out at the same time. That insures a varying density.

We have always found that the best way to examine these films is to hold them on the slant. I can see, or I think I can see, more gall-bladder shadows by holding the film on the slant than by looking squarely at it. If we see suspicious shadows and are not satisfied, we ought to see those shadows on more than one plate or film.

There is one thing I noticed in the discussion. Dr. Crane says he is able to detect only 10 per cent gall-stones. I do not think that is anything surprising, because in gall-bladders in which we can see only one stone on our plate or film, there may be found eight or ten stones at operation as I have shown on slides. The question of gall-stones is of very small moment. It is the gall-bladder that we are interested in. Gall-stones are usually of secondary importance to gall-bladder pathology.

Another thing that will influence our statistics is that they are made up from cases operated upon. I do not say that every gall-bladder we can demonstrate is pathologic. It may not be pathologic enough to warrant surgical interference. So there are a number of cases on which we have no check. If we could prove them up definitely, our statistics might be materially reduced.

Regarding the subject of the duodenal stasis, I think Case called attention to this in 1913. He said that in gall-bladder pathology he had observed a dilatation of the first portion of the duodenum, also a tender point immediately to the right of the duodenal cap. He thought then it was due to the rapid emptying of the stomach, thereby dilating the first portion of the duodenum. I have tried to follow this work out, and have not been able to satisfy myself that it is constant enough to place much emphasis on; though, as I said, our series of cases is quite small.

Regarding Dr. Crane's discussion, I think we should not report gall-stones primarily, but *gall-bladder pathology*. I want to emphasize that one point. I think all we are interested in is whether or not the gall-bladder is pathologic. Of course, if we see definite gall-stone shadows, we report them. If you report a case as a pathologic gall-bladder with no stones, and the surgeon operates and finds definite gall-bladder pathology and cholesterin stones, he is apt to discount your work more than he is entitled to, merely because you didn't report the stones; so we always report "pathologic gall-bladder with or without stones." It is my opinion from many conversations with Dr. George that he has been misunderstood when he has been quoted as saying that he could diagnose 90 per cent of gall-stones. I think what he meant was that he could diagnoes 90 per cent of pathologic gall-bladders.

THE ROENTGEN RAY IN THE DIAGNOSIS OF SCOLIOSIS*

BY FRANK W. LAMB, M.D.

PORTLAND, MAINE

BEFORE entering upon a discussion of the value of the *x*-ray examination as a diagnostic agent in scoliosis, it is necessary to consider at some length its pathology, and to emphasize the fact that the so-called functional or habitual scoliosis, which is not a deformity but simply a normal physiological posture, is to be in no way confounded with the term scoliosis used in this paper.

True scoliosis is a fixed deformity of the spine, characterized by a lateral bending of the column, with structural changes in the parts entering into it, together with a rotation of the bodies of the vertebrae on their vertical axes. The rotation of the bodies is always toward the convexity of the curve with the greatest amount of rotation at its apex.

The lateral bending of the spine may be either to the right or to the left, and there may be a single curve, or more than one. In the latter case, the curves are in opposite directions.

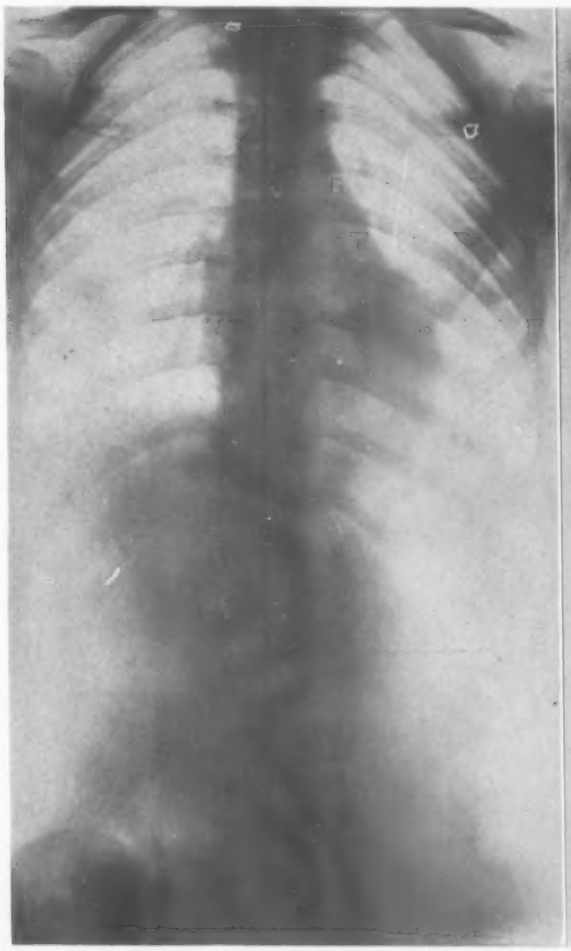

FIG. 1. *X*-ray of model standing, showing spine straight.

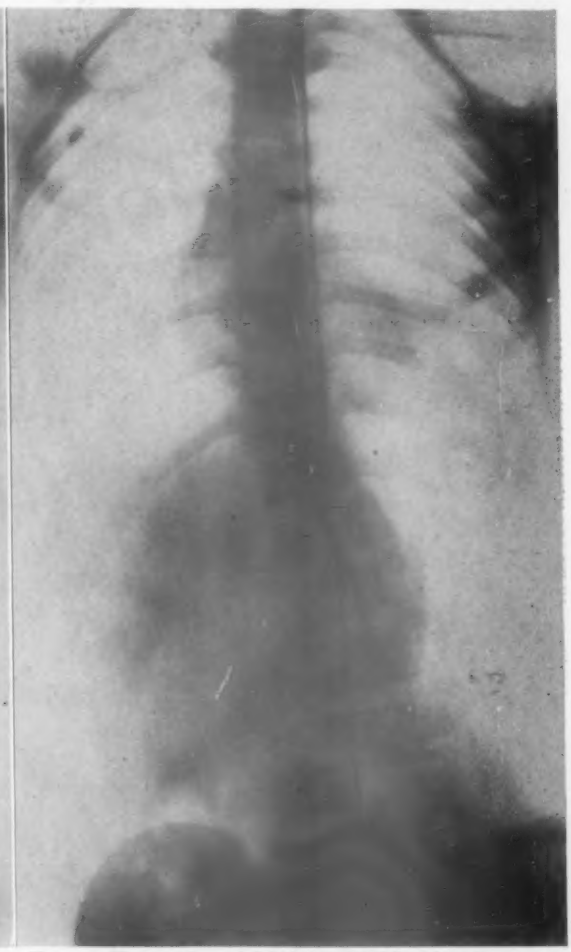

FIG. 2. *X*-ray of model lying on table, showing an apparent scoliosis.

* Thesis presented with application for membership to THE AMERICAN ROENTGEN RAY SOCIETY in 1920.

FIG. 3. Model in frame showing normal right scoliotic position.

FIG. 4. Model in frame showing normal left scoliotic position.

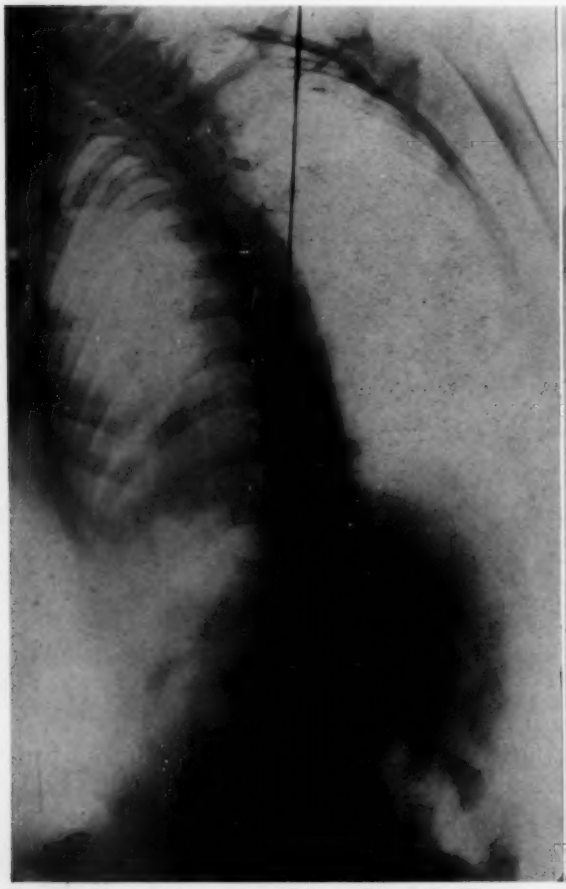

FIG. 5. *X*-ray of same model as shown in Figure 2, showing spine in right scoliotic position.

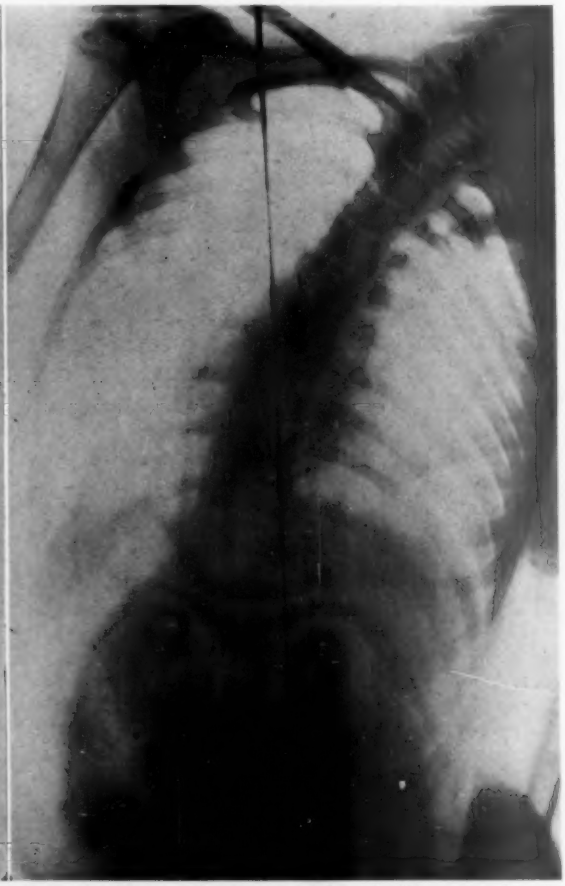

FIG. 6. *X*-ray of same model as in Figure 5, showing spine in left scoliotic position. This with Figure 5 shows the bending in both directions to be symmetrical.

The structural changes which take place cause a certain amount of the deformity, the ligaments and muscles shorten on one side of the spinal column and lengthen on the other, and finally the vertebrae change from their normal contour.

assume this position either to the right or to the left. These two positions, right and left, may be termed normal physiological scoliotic positions. This physiological scoliotic position is entirely distinct from a lateral bending of the spine and must not

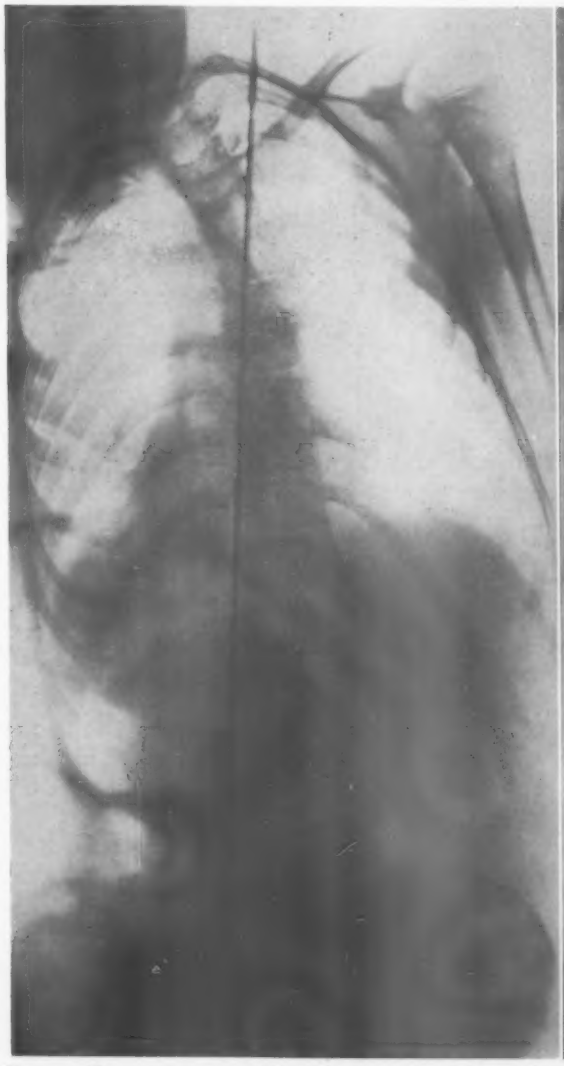

FIG. 7. *X*-ray of a model bending to left with a right scoliosis.

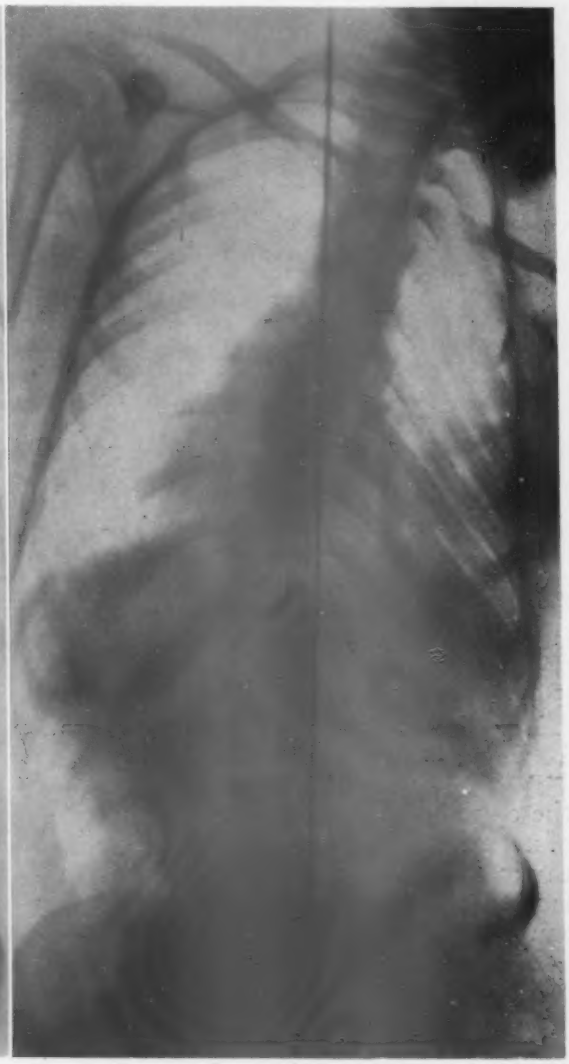

FIG. 8. *X*-ray of same model as in Figure 7, bending to right. Spine cannot assume the curves diametrically opposed to those shown in Figure 7 because of the fixed right scoliosis.

In studying the normal physiological postures of the spine, it is found that one of them is identical with the posture of scoliosis, the parts deviate to one side of the median line and the vertebrae rotate in the same manner as found in scoliosis. It is also found that the normal spine can be confounded with it, as there is no relation between the two.

In the normal spine, the physiological scoliotic posture, either right or left may be readily assumed, but in scoliosis, while the correct anatomical position—the straight position—may be assumed with

more or less ease, the structural changes which the parts have undergone prevent motion to the normal physiological scoliotic position opposed to the deformity.

Scoliosis is simply a fixation, not without motion, of the spine in either right or left normal physiological scoliotic posture. In other words, the spine, which is in one of its scoliotic postures, has its motion so restricted that it cannot assume

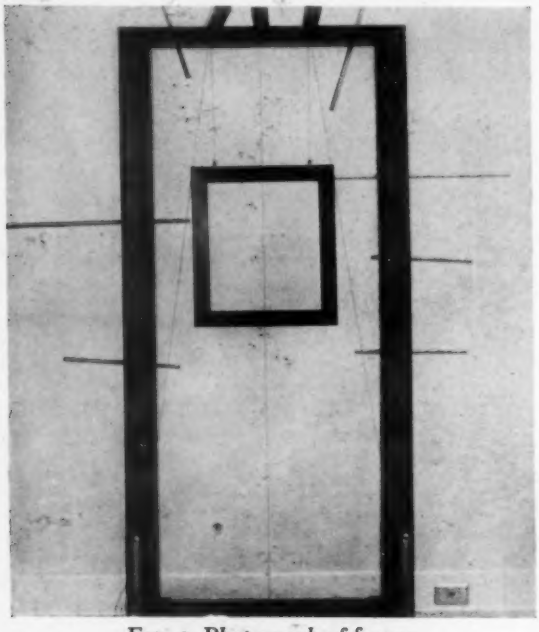

FIG. 9. Photograph of frame.

the opposed scoliotic posture to the limits of normal motion, but the straight position can in early cases readily be taken, and the fact that the correct anatomical position can be assumed does not exclude scoliosis.

The methods heretofore in use for examining the spine have been so faulty and misleading that it was impossible to establish the presence of the deformity until it had reached an advanced stage of development, and treatment was thereby rendered difficult, or even impossible.

The diagnosis of scoliosis in its early stages is important, because when deformity of the bones is well established, and changes in the length of the muscles and ligaments are extensive, great force is necessary to establish normal motion, and the very limited motion often present in some cases, where diagnosis is delayed, complicates or prohibits the process of reduction.

In order to establish a diagnosis of scoliosis in its early stages, it is absolutely necessary to know the normal physiological scoliotic postures of the spine, for unless they are known, one of them may be easily taken for the deformity.

If scoliosis were simply a lateral bending of the spine to left or right, the old method of marking the skin over the spinous processes might well have been an important factor in making a diagnosis. It has, however, proved most misleading, and in beginning scoliosis is absolutely useless. The spine is so flexible that in beginning scoliosis the spinous processes may appear straight or curved, and the fact that a patient can easily stand so that no deformity is shown is no indication of its absence; i.e., although the patient may easily hold himself so that the marked spinous processes show a straight line, there is frequently a well-defined deformity of scoliosis.

It is necessary then, if a diagnosis of the deformity is to be made before it has become so extreme that it is difficult to reduce, that some other method should be employed.

A correct diagnosis, however, even in the earliest stages, may be made by the use of *x*-rays, but only if the operator recognizes the fact that the old positions produce misleading roentgenograms.

A patient with beginning scoliosis may easily stand with the spine straight while a plate is being made (Fig. 1) and the plate may then show a normal spine. If the patient is supine on the table, the normal spine may, on account of its flexibility, show lateral bending (Fig. 2), while the scoliotic spine will frequently show straight, since most early cases can bring the spine to the straight position.

For these reasons, all exposures made in either of the above positions are valueless. It is only by bending the spine laterally and twisting the vertebrae at the same time into the opposed positions, that the deformity of scoliosis can be determined.

In making an *x*-ray diagnosis of scoliosis, the extreme right and left scoliotic position must be used (Figs. 3 and 4). If

the roentgenograms taken in these two positions show the lateral bending and the rotation equal and symmetrical (Figs. 5 and 6) there is no deformity.

On the other hand, if the patient is placed in the two positions above mentioned (Figs. 3 and 4) and the roentgenograms are asymmetrical (Figs. 7 and 8), there is a fixed deformity.

In order to hold the patient in position, some such frame as is shown in Figure 9 is advisable. This frame is constructed with a base and two uprights connected at the top by a bar; at regular intervals holes are bored, through which half-inch dowels may be inserted. These dowels are marked every half-inch and are used, not so much for support, as to aid in placing the patient in the same relative position to right and left. On each side, two dowels are inserted at such a height that the inner end of one touches the patient just below the ilia, and of the other, the outer side of the right shoulder. The cross-piece at the top is also bored, and a dowel rests on the top of each shoulder. From the middle of the top piece to the base extends a wire plumb for the purpose of showing a line on the plate to be used in making measurements.

The small square frame shown in the photograph is to hold the plate or film.

REPORT OF AN UNUSUAL FOREIGN BODY IN THE ARM

BY CHARLES FREDERICK BAKER, M.D.

NEWARK, NEW JERSEY

IN February of this year a woman fell on the ice. There was entire loss of function at the elbow with the presence of a small wound on the posterior surface of the forearm, just below the joint.

FIG. 1. Lateral view showing lead pencil buried in soft structures of the forearm.

She was taken to a suburban hospital, where a diagnosis of traumatic elbow was made with a possibility either of a compound fracture or a dislocation. This appeared to be further substantiated by the projection of a small piece of "bone" from the wound. She was suffering both locally and from shock, hence no extensive examination was attempted.

FIG. 2. Anteroposterior view showing same.

The films made that day with a portable apparatus were not up to the standard owing to the presence of a right angle perforated aluminum splint and to a defect in the apparatus. The films were

considerably underexposed; furthermore, they seemed to contain artefacts and straight parallel lines, the significance of which at that time was not recognized.

The report rendered was negative as to fracture or dislocation, all the bones appearing quite normal.

Upon receiving the report, the surgeon in charge stated that he was positive as to the presence of a bone lesion, as he had pressed one of the fragments back under the skin at the time first aid was rendered, and that there was almost complete lack of flexion or extension at the elbow-joint.

Another examination was suggested, and the following day the patient was brought to the office. The new films clearly demonstrated that the lines, previously considered as artefacts, were due to the presence of a piece of lead pencil, 3½ inches long, which lay in front of and slightly to the outer side of the elbow-joint, the point having penetrated the muscles of the forearm just below the neck of the radius and lodging under the skin of the flexor surface. The bones at this examination were found to be normal. Flexion and extension were limited by the foreign body and neither by fracture or dislocation, and the "fragment," which the surgeon pressed back under the skin, was the blunt end of the pencil, which being hard and well covered with blood was easily mistaken for bone.

Upon questioning the patient, she remembered that there was a lead pencil in the silk bag she carried on her arm at the time of the fall, but could not remember having seen it since the injury. By a singular coincidence, therefore, the pencil must have been in such a position that, when the patient fell, it penetrated the silk bag and skin with sufficient force to drive it entirely through the transverse diameter of the forearm, almost burying it from sight, so that the blunt end was not recognized.

The pencil was removed by slightly enlarging the wound, and antitetanic antitoxin administered. Recovery was uneventful with complete restoration of function.

REPORT OF THREE UNUSUAL CASES

BY T. A. GROOVER, M.D., A. C. CHRISTIE, M.D., AND E. A. MERRITT, M.D.

WASHINGTON, D. C.

IN examining 35 cases by the pneumoperitoneum method we have noted an anomaly of the left lobe of the liver in two patients.

Both were examined for obscure intra-abdominal conditions and an error in the interpretation of the liver shadow led to an incorrect roentgen-ray report as demonstrated by subsequent laparotomy. It is

FIG. 1. Case I. Shows the right lobe of the liver (A) and left lobe (B) which is larger than the normal spleen, but which occupies the splenic area, and the spleen, which is markedly enlarged (C), is displaced downward; (D) normal eflt kidney.

exceedingly important to remember that the left lobe of the liver may occupy a position in the left abdomen, which in the average person is designated as the splenic area, inasmuch as it may be in contact with the left diaphragm and left lateral abdominal wall.

In our cases, the tight lacing habit in girlhood in all probability contributed to or may have caused this condition, and that

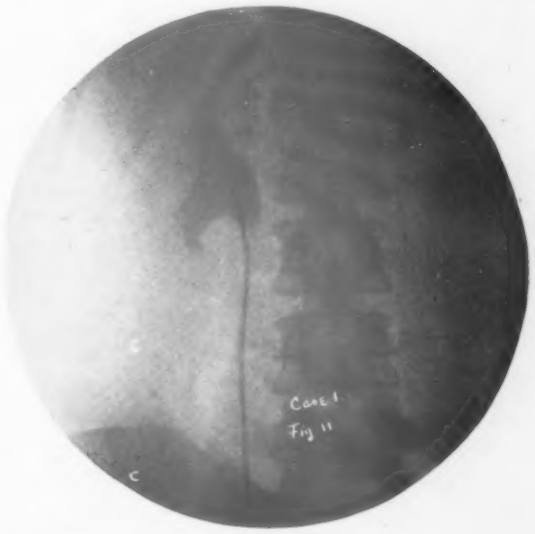

FIG. 2. Case I. Shows the left kidney in normal position above spleen and below left lobe of liver with pelvis and calyces normal in size and outline. Laparotomy revealed position of organs as above stated with a spleen increased in size incident to chronic malaria.

FIG. 3. CASE II. A liver similar to Case I, excepting for smaller left lobe (B).

it had been practiced is abundantly demonstrated by what we have designated as the "German helmet" liver, in which the contour of that structure is strikingly similar to a silhouette of this, now not unfamiliar head-gear.

Reproductions of the plates in these and our other cases are submitted for study.

FIG. 4. CASE II. Patient in same position, but plate made after a short interval. The spleen (C) has moved outward and upward. (D) normal kidneys. Laparotomy demonstrated structures as above stated with no surgical lesion.

FIG. 5. Case III. An unusual finding in a patient with perinephritic abscess, without the use of gas. Under fluoroscopic control the pelvis and calyces were outlined, showing some enlargement and deformity, while a thin stream of thorium apparently followed a course beyond the parenchyma of the kidney. This was due to a communication between the abscess and the pelvis of the kidney. The arrows in the illustration indicate the thorium shadow external to the pelvis.

TWO TABLES PERTAINING TO THE INCIDENCE OF BODILY HABITUS AND THE TIME OF COMPLETE GASTRIC MOTILITY IN DIFFERENT TYPES OF HABITUS

BY R. WALTER MILLS, M.D.

ST. LOUIS, MISSOURI

CERTAIN tables and statistics which have been in my possession as a part of a special investigation seem to me so necessary of general appreciation that I am presenting them in this informal form.

The first of these tables pertains to the incidence of different physical types which in a previous communication I have classified as the hypersthenic, sthenic, hyposthenic, and asthenic.* It seems not generally appreciated and certainly was not by me before tabulating this and other tables, that the numerical incidence of different types of individuals varies greatly. It will be noted in Table 1, which deals with this subject, that the larger proportion of persons fall in the intermediate, sthenic and hyposthenic groups, that the asthenic is a comparatively rare type and the hypersthenic quite so. We are doubtless misled in our subjective appreciation of the incidence of these types by the fact that a larger percentage of asthenics, being more subject to functional digestive disturbances and probably organic lesions, is seen by us in practice, and we consequently do not appreciate that this is not a reflection of their actual incidence which, as mentioned, is comparatively infrequent. In a different manner the hypersthenic type is perhaps impressed upon us by vastness of bulk, weight, and so on, in individuals of such habitus, so that we do not appreciate the fact that they are quite rare as compared to the general run of persons.

It is desirable for the reader to understand, however, that in the present tabulation of the incidence of different types, those rated as hypersthenic and asthenic are so classified on a strict standard. For instance, many persons who might superficially be considered as asthenic, on closer examination, are found not so, but to be essentially of the next higher type, the hyposthenic only tending to the asthenic. The same is true of sthenic individuals who tend to the hypersthenic. But in this connection individuals who are surely either hypersthenic or asthenic, but somewhat tend in turn to the sthenic or hyposthenic have been classified as primarily of the type to which they essentially belong. All this means that individuals shoud be closely studied before classification, as has been done in this instance, in which photos and numerous orthodiagraphic tracings, general scale reductions and graphic figure drawings have been made of all subjects before final classification. Incidentally, it is curious that one cannot sum up all physical proportions without a photograph. We are so impressed by other features, such as texture of skin, moulding of form and other minor features that we do not readily summarize great general proportions.

As mentioned, the greatly predominating sthenic and hyposthenic types represent a mean, or, as one might say, the average type, and perhaps might so be considered as "normal" by those who long for and can be mentally satisfied only with a monotype standard, with variations from such considered as abnormalities.

The practical import and value of an appreciation of variation in the incidence of types above mentioned leads in several directions. First and most important, as to the incidence of disease as occurring in different types of bodily habitus. Since we have learned that to a degree certain diseases or predilection to diseases and certain undesirable conditions are characteristic of certain types of persons, it follows that no true estimate of such predilection will be accurate without an appreciation of the numerical incidence of

* Mills, R. Walter. The relation of bodily habitus to visceral form, position, tonus and motility. AM. J. ROENTGENOL., April, 1917, iv, 155–169.

different types. For instance, it is well established that tuberculosis, or rather lack of resistance to it, is more marked in the asthenic. Judging by the comparative rarity of this type, this predilection is far more marked than is at first apparent, since the asthenic is comparatively rare.

Another aspect of the incidence of clinical disease with reference to physical type may be illustrated by duodenal ulcer. Many have doubtless been impressed as was I with the apparent preponderance of duodenal ulcer in heavy well-nourished persons of the more sthenic types. As a matter of fact, the reverse is true; duodenal ulcer is almost twice as frequent in the asthenic as in the sthenic. It only seems that a larger number of sthenic persons are subject to duodenal ulcer because of the larger number of sthenics and the comparative rarity of asthenics, and because duodenal ulcer happens to be a disease that more nearly affects all types alike. The same interesting disease incidence with reference to habitus may be followed through various diseases, such as colonic diverticulosis, gastric ulcer, arterial hypertension, apoplexy and multitudinous malstatic states, to great diagnostic and therapeutic, and especially prophylactic, advantage.

A second advantage to be derived from a consideration of the incidence of different physical types is in the establishment of approximate "normal" figures as to various physiological manifestations. For instance, the time of complete gastric motility, as is apparent in the second table. Since gastric motility is more rapid in the hypersthenic individual and definitely slower in the asthenic, it follows that what for practical purposes we might consider as the "normal" time of gastric motility, if one must have such, is best taken essentially from the intermediate average sthenic and hyposthenic types, because in large measure they are in very considerable numerical preponderance. It would seem that this would be better judgment than to take the average time of all types, no matter what their numerical incidence. The same process of reasoning would lead to the determination of other physiological norms along similar lines. Personally, I have been impressed with the idea that the degree of gastric secretion as determined by the

Table I. A table showing the incidence of bodily types, the relation of such to sex and the degree to which a single visceral structure, the stomach, corresponds to habitus as to its form, topography and tonus. It will be noted that there is a marked variation in the percentage of incidence of different types, that most physiques are of intermediate sort, sthenic and hyposthenic, and that the asthenic is rare and the hypersthenic even more so. These facts should be taken into consideration in statistics as in the incidence of disease as affecting different types, and in other similar considerations. It may be noted that there are more sthenics among males than females, and conversely that there are more asthenics females than males; and that consequently figures pertaining to sex incidence with reference to bodily type form a reversing gradient when arranged on a sex basis.

The final figure shows that, using the stomach as a test, visceral peculiarities fairly closely correspond to bodily type, that is, in approximately 80 per cent of all persons. Figures are those taken from studies of 1,000 subjects without known organic or marked functional disturbances.

Table I

CONSTANCY OF RELATIONSHIP OF STOMACH FORM AND POSITION TO BODILY HABITUS IN 1,000 SUBJECTS WITHOUT KNOWN ORGANIC OR MARKED FUNCTIONAL DISTURBANCES

Incidence of Habitus		Incidence of Sex		Relation of Stomach to Habitus		
Habitus	Number and Percentage of Subjects Arranged According to Habitus	Number of Male Subjects and Percentage of Each Type	Number of Female subjects and Percentage of Each Type	Number and Percentage of Cases in Which Stomach Corresponds to Habitus	Number and Percentage of Male Subjects in Which Stomach Corresponds to Habitus	Number and Percentage of Female Subjects in Which Stomach Corresponds to Habitus
Hypersthenic	47– 4.7	42–89.4 ↑	5–10.6 ↓	44–93.6	39–92.8	5–100.0
Sthenic	481– 48.1	288–59.9	193–40.1	395–82.1	257–89.2	138– 71.5
Hyposthenic	354– 35.4	143–40.4	211–59.6	262–74.0	117–81.8	145– 68.7
Asthenic	118– 11.8	24–20.3 ↓	94–79.7 ↑	98–83.1	19–79.2	79– 84.0
Total	1,000–100.0	497–49.7	503–50.3	799–79.9	432–86.9	367– 73.0

usual Ewald-Boas meal corresponds to physical type, being higher in the sthenic and lower in the hyposthenic and asthenic types. It may be that the faster gastric motility of the sthenic makes this apparent only, since the recovery of this test meal at forty-five minutes or one hour cuts through the various curves of gastric secretion in the various types at different levels, judging by their known different rates of motility and presumably corresponding rates of secretion. We may then come to consider that on the same time test the at that time present acidities of the stomach vary in a general way according to type just as does gastric motility. For practical purposes, however, since it might complicate matters to an impractical degree to attempt a judgment of gastric secretion on the basis of the individual type, it would seem better judgment to determine secretions in all types at a given time, and judge the result in the light of the type under examination. The same for gastric motility. It would thus seem better to judge *x*-ray gastric motility essentially on a six-hour observation, considering also intestinal distribution, and to interpret the result in the light of the type of individual and the rate of gastric motility characteristic of such, than to attempt a different time standard of motility for each type. My own method, however, is, while not carrying gastric motility observations beyond the six-hour period, to determine as closely as possible the actual time of stomach emptying, and then judge this in the light of the type of habitus of that particular case. Another example of physiological function that also probably follows a general relationship to physical type is alimentary motility in general, reflected in the frequency of defecation. As I have elsewhere stated, in markedly sthenic types defecation is frequent, twice or more times daily; while in the asthenic I might subscribe to the rank heresy that the lack of a daily bowel movement is not necessarily abnormal. Blood-pressure also seems to correspond to bodily type, being higher in the sthenic and lower in the asthenic. There seems also a relationship to physical type in functional attributes, general muscular tonus reflex reaction, mental peculiarities, endurance, and many other things that we subconsciously so appreciate, but through familiarity do not pause to crystallize in our minds until in some manner the facts are shunted to our attention. The same line of observation and reasoning is far-reaching in directions other than strictly medical, as in occupational therapy, in insurance statistics (which, by the way, if arranged on these lines will be definitely hard on the asthenic), in purely commercial activities as pertaining to the examination and employment of persons and selection of individuals for various activities such as factory work and military service, and above all, in the future application of these facts in practical eugenics.

In the table submitted, it will be noted that there are figures as to the extent of correspondence of the stomach to bodily habitus, the stomach serving as a single test example of the relationship of a viscus to bodily habitus. Figures are arranged so as to test the proposition that I have elsewhere advanced that all visceral peculiarities, structural and physiological, correlate bodily type. It will be noted in these tables that the stomach corresponds to bodily type in approximately 80 per cent (79.9 per cent) of all cases. It will also be noted that this correspondence varies with the degree to which a physical type deviates from the mean. For instance, that in extremes of bodily habitus, the hypersthenic and asthenic, the figures indicate, as might be anticipated, a more definite relationship than in average types in which all structural peculiarities approximate the average, and consequently in which individual variation plays a greater part making for disharmony.

There are interesting figures in the tables pertaining to the incidence of habitus as it relates to sex. It will be noted that hypersthenics are far more commonly men than women, that asthenics are correspondingly more frequent among women than men, and that with the percentage of intermediate types a reversing gradient is formed when figures are arranged on a sex basis (Columns 2 and 3). Consequently the classification of all individuals on

bodily peculiarities as based on the classification previously proposed is perhaps in a measure a classification of sex peculiarities.

In addition to the table discussed (Table 1) a second similar table was compiled, consisting of 2,500 additional cases, but of subjects not completely free from pathological states; this primarily for testing the incidence of gastro-intestinal disease with reference to habitus. It is of interest, however, in conjunction with the foregoing, that in this table also, which is not presented at this time, the figures are almost identical with those of the first table of persons free from organic or marked functional disturbances as to the incidence of physical types; the figures of incidence being: Hypersthenics, 91 or 3.6 per cent, sthenics, 1,117 or 44.7 per cent, hyposthenics, 945 or 37.8 per cent, and asthenics, 347 or 13.9 per cent.

Table II. A table showing the relationship of the time of gastric emptying in bodily types. It will be noted that gastric motility is progressively slower from the hypersthenic to the asthenic. This fact should be taken into consideration in fine diagnostic work.

TABLE II

AVERAGE GASTRIC EMPTYING TIME OF DIFFERENT HABITUS FIGURED ON BASIS OF 1,000 SUBJECTS WITHOUT ORGANIC OR MARKED FUNCTIONAL GASTRO-INTESTINAL DISTURBANCES

Habitus	Average Total Motility Time	Difference between Times of Gastric Motility in Different Habitus
Hypersthenic.....	4 hrs. 22 min.	
		24 min.
Sthenic.....	4 hrs. 46 min.	
		40 min.
Hyposthenic.....	5 hrs. 26 min.	
		17 min.
Asthenic.....	5 hrs. 43 min.	

Average emptying time in all types of habitus: 5 hrs. 4 min.

The second table deals with a more simple problem, the rate of gastric motility in different types of individuals. Results were published in a previous communication.* It may serve to illustrate a single proposition of those suggestions in the foregoing. This table was compiled after an ordinary contrast artificial buttermilk meal with a preliminary water mixture, and on the determination of the exact time of gastric motility in 1,000 individuals to within fifteen minutes. The subjects under test were the same as those used in compiling the first table. It may be recalled that they were without known organic or marked functional disturbances, and may be considered approximately normal. It will be noted that the different times of gastric motility vary definitely and progressively in the several types so as to form a quite uniform gradient. Extremes in round numbers are from four hours and fifteen minutes on the average in hypersthenics to five hours and forty-five minutes on the average in asthenics. The most rapid gastric motility observed was one hour and fifteen minutes in an hypersthenic individual, and a six-hour residue was so frequent in marked asthenics that it can hardly be considered as actually abnormal. The practical inference of this information is great in judging gastric motility. We cannot say that because an hypersthenic person has no six-hour residue, his gastric motility is within normal limits. If his stomach total motility were completed only at five and three-quarters hours it would be as abnormal for him as a six and one-half-hour period for an asthenic. Contrary-wise, a six-hour residue in an asthenic has no such diagnostic significance as has a five and three-quarter-hour residue in an hypersthenic. To summarize: For fine diagnostic work the type of the individual must be taken into consideration in judging the period of complete gastric motility, irrespective of the type of meal used. As suggested previously, I feel, however, that it would be best to hold to the six-hour period as a standard time test, and judge individual motilities in light of bodily type and its associated rate of total motility.

* Mills, R. Walter. The x-ray test of gastric motility. *Tr. Am. Gastro-Enterol. Assn.*, 1918.

THE ROENTGEN-RAY LABORATORY OF THE UNIVERSITY HOSPITAL, PHILADELPHIA

BY EUGENE P. PENDERGRASS, M.D.

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AND

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PHILADELPHIA, PENNSYLVANIA

THE value of the roentgen-ray laboratory depends greatly upon its organization and its equipment, and as we are frequently asked for general information regarding the establishment of a laboratory, a description of our department may be of interest to one planning a new laboratory.

The space devoted to a roentgen-ray department should be ample. Our laboratory occupies approximately 10,000 square feet. It is located on the ground floor of the hospital. There is abundant sunlight and ample ventilation facilities. In addition to the numerous windows there is a modern ventilating outfit, thus reducing the products of disintegration by high tension current to a minimum. The floor is divided into rooms, as seen in Figure 1.

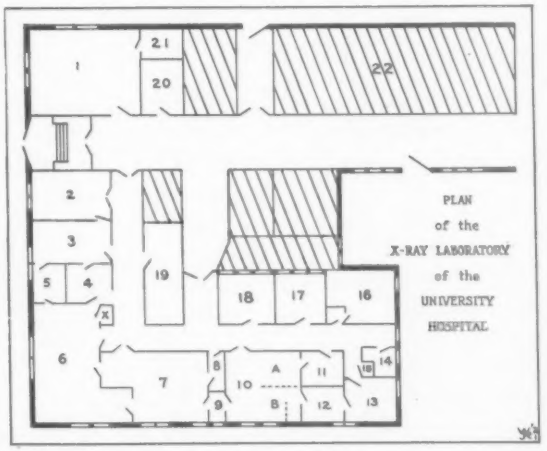


FIG. 1. (1) Demonstration and lecture room; records kept here also. (2) Private waiting-room. (3) Private office. (4) Examining and dressing room. (5) Lavatory. (6) General roentgenographic room. (7) Fluoroscopic room. (8) Dressing room. (9) Treatment control room. (10) Roentgen therapy room. (11) Dressing-room. (12) Room used for making lantern slides or making reductions. (13) Chemical room. (14) Lavatory. (15) Service room. (16) Dark room. (17) Photographic and radium treatment room. (18) Small roentgenographic room. (19) Demonstration and film filing room. (20) Film filing room. (21) Supplies. (22) Room reserved for deep therapy.

In addition to adequate ventilation facilities, another important consideration is the protection of the staff from constant exposure to the roentgen rays. This is met by having the walls of the general radiographic, fluoroscopic and treatment rooms lined by sheet lead of adequate thickness. The protection of the operator will be taken up more in detail later.

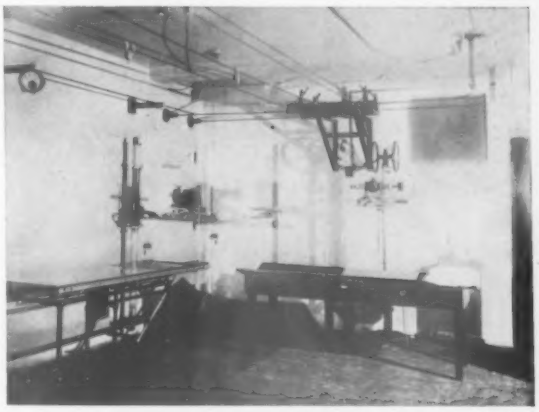


FIG. 2. A portion of the general roentgenographic room.

The maintenance of a roentgen-ray laboratory is an expensive undertaking, especially as at this time numerous new devices and equipment are being put on the market. Naturally, some of the new appliances are not necessary, but one should have the essentials for accurate radiography.

Room 6, Figure 1, is the general roent-

genographic room. In this room all the roentgenographic work is performed with the exception of the gastrointestinal, and pyelogram examinations. The equipment in this room changes from time to time in order that it may be kept up-to-date. A list of the necessary apparatus includes: five adjustable roentgen-ray tube stands; vertical and horizontal plate changers; a horizontal table used for making serial

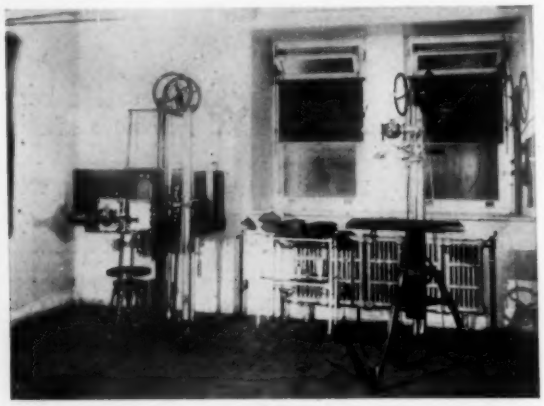


FIG 3. Another view of the general roentgenographic room.

roentgenograms (Fig. 2); a wooden table used in preparation for examination, and a Bucky diaphragm and table. Rooms 4 and 5 connect with the general roentgenographic rooms and are used as dressing rooms by the patients. Room × is a closet in which all the roentgen-ray tubes are kept.

The transformer supplying the current to the general roentgenographic room is placed in the cellar in a special room, which is dry and adequately ventilated. The placing of the transformer in the cellar does away with the noise of the motor, and at the same time saves floor space in the rooms. The control stand is placed in Room 7, and from here the operator makes his exposures, thus making it almost impossible for the operator to get very much, if any, exposure. The patient, at the same time, is in full view of the operator, who watches the patient through an opening covered with ½ inch of lead glass. The overhead system is constructed of ½ inch brass piping instead of wires, thus eliminating as much of the electrical discharge as possible.

Room 7, the fluoroscopic room, is connected with Room 6 by two doors. Its walls are painted black and the windows are covered by heavy black shutters to exclude all daylight. This room is furnished with a vertical and a horizontal fluoroscope with foot switches and rheostat controls with each fluoroscope. The table for making

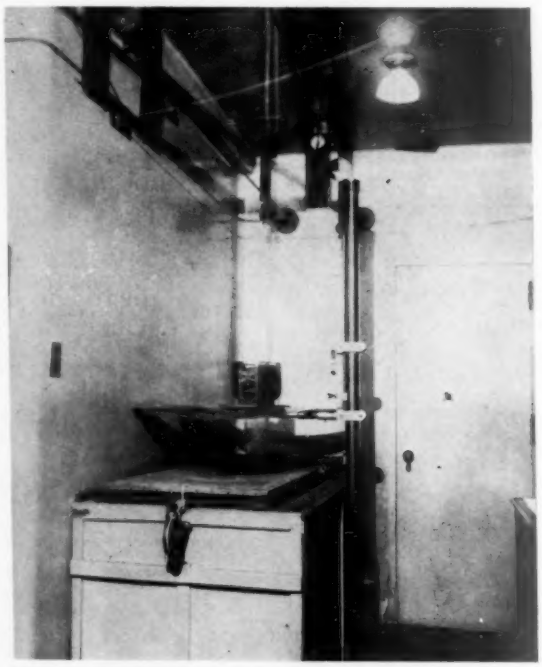


FIG. 4. Serial table used for gastrointestinal room and operated from adjacent room.

serial roentgenograms is operated from this room, although the table itself is placed in Room 6 (Fig. 4). We use the same transformer for fluoroscopic and roentgenographic rooms at the present time, but this is to be changed, and a separate transformer is to serve in each room. Room 8 is a dressing room used by patients preparing for fluoroscopic examinations.

Room 18 is a small room in which all simple examinations can be made. It is equipped with two adjustable tube stands, a Bucky diaphragm and table and an adjustable tripod table for examination

of the upper extremities. The source of the high voltage current for this room is a bedside unit; that is, the transformer control stand and meters are all in one portable cabinet, which is connected to an overhead system similar to the one in the general examining room. This unit can be moved to any part of the hospital for the examination of patients who cannot be sent to the roentgen-ray department.

Room 16 is the dark room. It is provided with two large stone tanks, so as to give ample developing space. Numerous racks, around which the air is circulated by an electric and an exhaust fan, assure rapid and uniform drying of the films. The shelf and closet space is generous and sufficient for the stock of unexposed films.

Room 12 is a small room used for making reductions or lantern slides of films. The equipment consists of four Cooper-Hewitt lights used for illumination and the apparatus and camera. A small dark room is included so that the slides can be developed without interrupting the work of the other dark room.

Room 10, the treatment room, is divided by a partition, so that two patients may be treated at the same time. The room is equipped with two adjustable tube stands. The tube bowls have had an additional safety device added to them; that is, the space occupied by the terminals of the tube have been surrounded by fiber and rubber steam packing, thus making it almost impossible for the tube to come in contact with the patient. There are two wooden tables, on each of which are placed 4 inch mattresses. The air is constantly changed by two fans, one in the room and an exhaust fan, which has a displacement capacity of 2,600 cu. ft. per minute.

Room 9 is the control room, in which are placed the two control stands. The nurse operating the machines stands in this room and watches the meters, patients and tubes through a window covered with ½ inch lead glass. The transformers are placed in a separate room in the cellar which is dry and well ventilated.

Room 10 is connected with two dressing rooms, Room 11 and a small dressing room cut off from section B (Fig. 1).

Room 17 is an examining room; that is, it has the lights and accessories for making an efficient examination of the mouth and larynx. This room is also used for radium cases which only require a short seance. It is also used as a photographic room to take pictures of the lesions of the cases under treatment.

In addition to the above-mentioned rooms, there is a large basement under the laboratory in which there is a transformer room and also a large work shop where new apparatus and minor repairs are made. Room 22 is rather remote from the laboratory and has been reserved for deep roentgen therapy. When such a plant is established, Room 10 will be used as a roentgenographic room and Room 18 as a radium treatment room.

FIG. 5. A portion of the therapy room showing overhead system, tube stands and bowl with protection for terminals of tube and sphere gap.

The personnel of this laboratory consists of a director, two medical assistants, a resident intern, a technical assistant, two graduate nurses, a pupil nurse, an office manager, a stenographer and a filing clerk, all of whom, with the exception of one medical assistant, work at the laboratory all day.

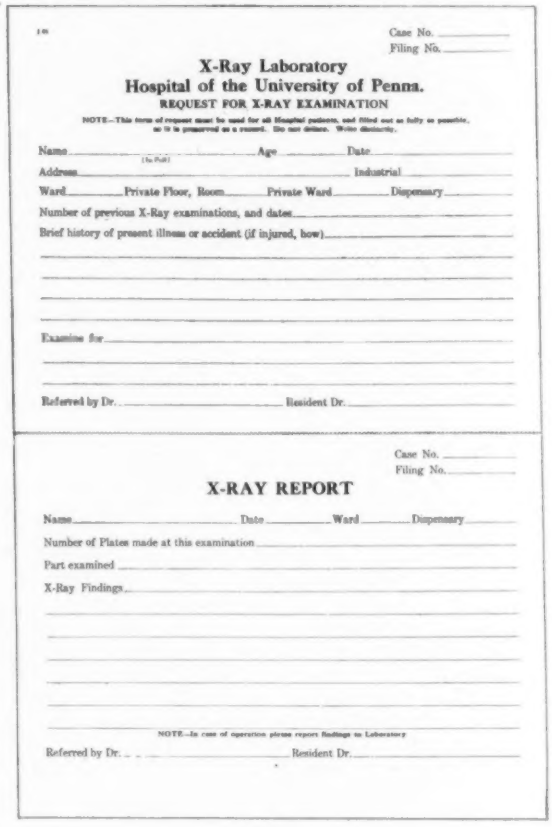
The office manager has charge of all appointments and sees all private patients and arranges for their instructions. To facilitate the handling of patients, and getting in touch with the members of the staff, an intercommunicating telephone system is installed from room to room. In addition to this there is a call bell system, each room having push buttons located on the walls. There are three outside phones.

In a department of this size, it is necessary that one have an efficient organization, otherwise delay will occur. This, of course, will have to be worked out in each laboratory, but generally we have divided the day, so that at a given time ward patients are examined, at another time private patients; in the afternoon gastro-intestinal examinations are made. The first hour in the morning is utilized for plate reading.

A complete record and filing system is very essential to every laboratory so that the records of any case previously examined may be looked up and obtained in a minimal amount of time. To give a concrete idea of our record and filing system, I will follow a case record through all branches of the laboratory.

The request blank (Fig. 6) is handed into our office and an appointment is given the patient. When the patient arrives in the laboratory, the nurse assisting in the roentgenographic room confirms or adds as much to the history as she can obtain from the patient. One question which should be asked of every patient is the number of previous roentgen-ray examinations and dates. Frequently we refuse to examine patients because they have had the maximum exposure elsewhere.

The nurse then fills out a blank similar to the one seen in Figure 7. This is placed with the plate or film after exposure, and sent to the dark room. After all films are developed, the filing clerk pastes the blanks (Fig. 7) on their several filing envelopes. The next morning the histories, envelopes and films are ready for diagnosis. After the diagnosis is written on blank (Fig. 7) it is given to the stenographer, who copies it on the roentgen-ray report blank of Figure 6. This blank is serrated; thus the report blank is returned to the history chart of the patient, and the request blank filed with the film. All these films are turned over to the filing clerk, who records in a book the name of



Case No. _____
Filing No. _____

X-Ray Laboratory
Hospital of the University of Penna.
REQUEST FOR X-RAY EXAMINATION

NOTE—This form of request must be used for all Hospital patients, and filled out as fully as possible, as it is preserved as a record. Do not delete. Write distinctly.

Name _____ (In Full) Age _____ Date _____
Address _____ Industrial _____
Ward _____ Private Floor, Room _____ Private Ward _____ Dispensary _____
Number of previous X-Ray examinations, and dates _____
Brief history of present illness or accident (if injured, how) _____
Examine for _____
Referred by Dr. _____ Resident Dr. _____

Case No. _____
Filing No. _____

X-RAY REPORT

Name _____ Date _____ Ward _____ Dispensary _____
Number of Plates made at this examination _____
Part examined _____
X-Ray Findings _____

NOTE—In case of operation please report findings to Laboratory
Referred by Dr. _____ Resident Dr. _____

FIG. 6.

the patient, age and diagnosis, doctor referring case and films made. At the same time she gives the patient a case number and an index number and in addition makes out a card for the patient, which is filed according to the vowel system (Fig. 8).

The different parts of the body are given numbers; i.e., chests are given number 2, heads number 1 and spines 17, etc. By this method an index number is given each patient, so that in event of subsequent examinations of the same part of the body, the last films made may be filed with those made at the first examination. In addition, each patient receives a case number, which is given to the patient as a numerical number, and not one of a particular part of the body.

If the examination shows pathological changes, a cross-index card is made out

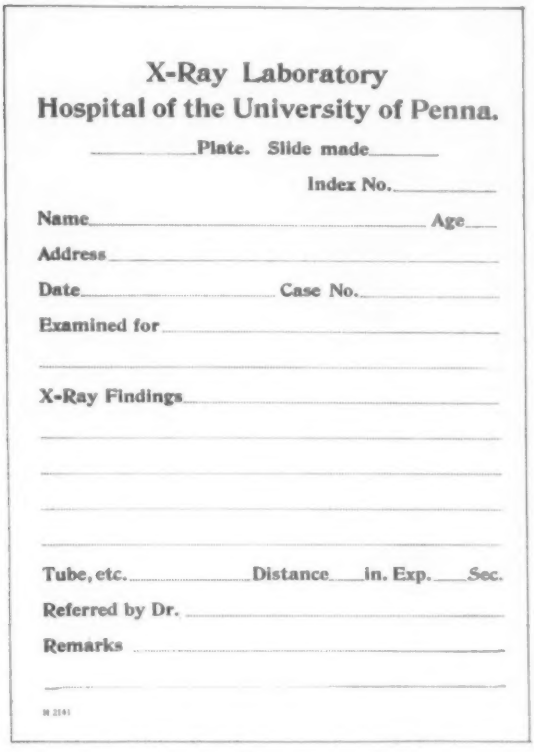

X-Ray Laboratory
Hospital of the University of Penna.

_____Plate. Slide made_____

Index No._____

Name_____ Age____

Address_____

Date_____ Case No._____

Examined for_____

X-Ray Findings_____

Tube, etc._____ Distance____ in. Exp.____ Sec.

Referred by Dr._____

Remarks_____

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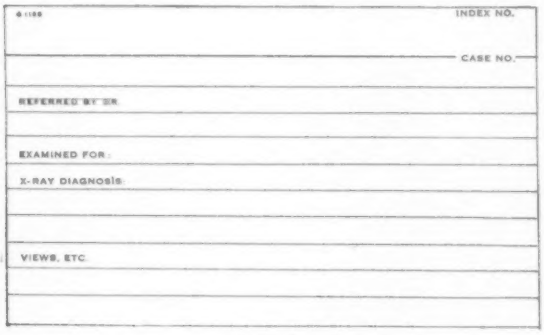
FIG. 7.

and filed according to diseases (Fig. 9). Thus we have a three-fold check on the patient in the laboratory.


INDEX NO.

CASE NO.

REFERRED BY DR.

EXAMINED FOR

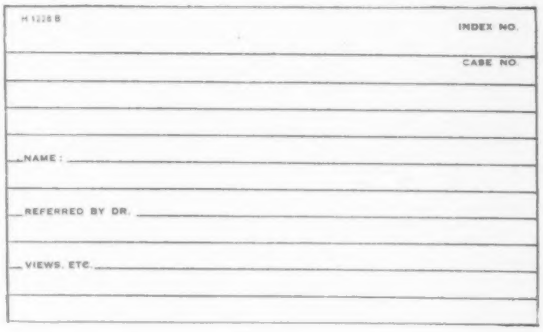
X-RAY DIAGNOSIS

VIEWS, ETC.

FIG. 8.

All special examinations requiring fluoroscopy have a typewritten report sent to the doctor, a copy pasted on the filing envelope and a copy filed and bound into a book.

The films are filed in steel cabinets in Rooms 19 and 20. In addition, there is a large room containing several thousand square feet of shelving space, in the cellar. Most of the negative films are thrown away after a year. Those showing pathological changes are kept for five years and then thrown away, after slides have been made. The slides are then filed according to the index number and disease.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CASE NO.

NAME:

REFERRED BY DR.

VIEWS, ETC.

FIG. 9.

In this laboratory, we have ample opportunity to discuss the clinical side of the patient with the clinician and surgeon. Twice a week the medical men meet with us and the clinical and roentgen-ray findings are discussed, thus affording the best possible methods of arriving at the proper diagnosis.

CONCLUSION

It is well understood that the description of the above laboratory may be too elaborate for some hospitals and inadequate for others, but our hope is, that someone may get some benefit from our experience. Any laboratory planned in the future cannot be safely constructed and equipped without taking into consideration the rules which will be outlined by the Safety Committee of the American Roentgen-Ray Society.

ROENTGEN THERAPY IN DENTISTRY

BY JOHN L. GARRETSON, D.D.S.

BUFFALO, NEW YORK

WITH many physicians, the use of the *x*-rays in the treatment of various diseases is a comparatively old story.

The dentist, on the other hand, has confined his use of it to radiograms of the teeth and the jaws, to locate areas of bone and tooth disease, and to observe the results of treatment. The equipment which he has at his disposal has been for the purpose of radiography only, making it impossible for him to advance farther and observe the effects produced by *x*-ray therapy as applied to the gums and other oral tissues.

The dental profession have spared nothing in their efforts to find the causes and the best treatments for the disease commonly known as pyorrhea; every institution of research and the most noted clinics of medical investigation have been conducting exhaustive inquiries and studying this disease, hoping to find the cause and the cure. Much knowledge has been collected and many treatments instituted which have been found to be of value. The researches of Howe by injection of the bacteria of the pyorrhea pocket into normal healthy gum tissue, showed that he could not cause the disease, and that the etiological factors were to be found in some other way.

The researches of Dewey* and Noyes have proved that the infiltration of the lymphatic tissue, found in the peridental membrane and the gums, is the greatest factor in the cause of the recurrent infections of this disease.

The condition of the gums found in pyorrhea happens, in many cases, at a time when the metabolic conditions are at a low ebb, and the tissues are unable to throw off disease, and remain in a state of such lowered vitality that it is impossible for them to recover. The inflammation of the peridental membrane and the gums continues as the infection penetrates the lymphatics. Following the treatment of these lymphatic areas by the *x*-rays, absorption takes place which lessens the pressure of the swollen parts, and results in the restoration of the tissues.

In suggesting this method of treatment, I am applying the *x*-rays in doses which it has been common for the medical roentgenotherapist to use in other pathological cases.

It is to be hoped that the principle of the method here presented will be the part to be considered, and not the fitness of the dentist to undertake this work without thorough preparation. In all my papers before the dental societies I have warned the members against experimenting without a full knowledge of all the effects of the use and misuse of the *x*-rays, the protecting of the patient, and the use of a correct known dosage. One should guard against the use of any supplemental treatment by the employment of tissue stimulants such as iodine, scarlet red or any similar agents, as these have a reputation for causing violent sloughing when used during *x*-ray treatment.

The treatment of pyorrhea requires all the skill at our command in cleaning up the tartar and the products of the inflammation to prevent its further irritating influence, so that the greatest benefit can accrue from the *x*-ray treatment with the smallest number of doses.

Experimentally it is a simple matter to observe the influence of our treatment on the tissues without doing anything in the way of scaling and polishing the teeth. Here it is hoped that this method can be applied to the very sick and to those who are neglected and have very foul mouths. Again, it may be applied to those cases where it is suspected that the metabolic conditions will be apt to cause pyorrhea, and in this way keep the mouths of our patients in a state of health during sickness and convalescence.

My experiments have shown many fortunate effects, by-products of the treatment,

* DEWEY, KARTHE, and NOYES, FREDERICK B., A study of lymphatic vessels in the dental pulp. *Dental Cosmos*, April, 1917.

as it were; swellings from jaw infections have subsided, pain and soreness have left the parts, and cases of neuritis have, after long years' standing, remained quiet as the result of a few doses of the *x*-rays, and have apparently been greatly influenced by this form of treatment.

FIG. 1. An early method of protection used by the author.

It is hard to mention such findings without what might seem to be extravagant statements. But in order that the greatest good may come to our patients and these phenomenon be observed by all investigators in this field of research, I ask leave to mention them; for if they prove constant in the future, they will be of great value to our profession in the treatment of many obstinate and painful diseases.

In the near future I expect to be able to present to you the findings in a large number of cases where roentgen therapy was employed; also the histological and pathological findings which are now being secured.

Mention of the anodyne effects of the *x*-rays to operators in different fields of research has often brought forth the remark that they have observed similar effects, even from the use of very small doses such as they would use in the making of a few *x*-ray examinations of the teeth.

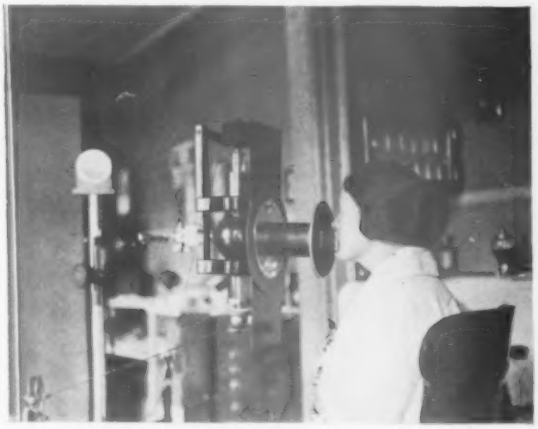

FIG. 2. Improved diaphragm allowing the *x*-ray to be applied to a definite area. Recording the area by marking automatically a square area which received the ray.

The technique that I employ* is based upon the mathematical formulae as outlined by W. D. Witherbee, M.D. of New York, and others.

SUMMARY

X-ray therapy may be employed in the treatment of the conditions of the teeth and the gums where the effect is to reduce the pain and other symptoms of inflammation, affording relief in a great variety of dental diseases. This is due to the effect of the *x*-rays on the lymphatic tissue.

The new factors in determining the dosage make it an easy matter to apply the method in treatment with a feeling of assurance that one is using factors which are under his direct control. It is hardly to be expected that dentists will attempt *x*-ray treatment with improper apparatus.

* GARRETSON, JOHN L. Employment of *x*-ray dosage in the treatment of pyorrhea. *Dental Cosmos*, November, 1921.

THE VAN ZWALUWENBURG TYPE OF STEREOSCOPE

BY S. W. DONALDSON, M.D., AND E. F. MERRILL, M.D.

From the Department of Roentgenology, University of Michigan

ANN ARBOR, MICHIGAN

THE advantages of using the stereoscope method have long been recognized by the majority of roentgenologists. Consequently, several types of stereoscope have been devised, employing the prism, single mirror (French type), and the 90° mirrors.

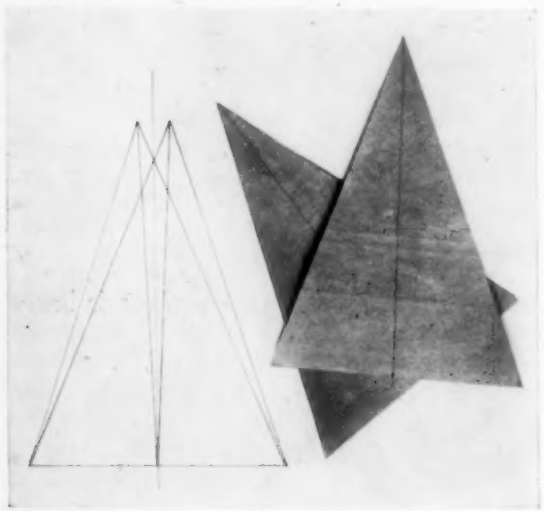

FIG. 1. Triangles erected on a common base, and two triangles of the same dimensions cut from colored paper.

In addition to its value as a means of studying plates, the stereoscope is appreciated by the visiting physicians and hospital staff members, who like to have pointed out to them the important pathological findings. In order to do this with ease, it is practically necessary that both demonstrator and the person to whom the plates are being demonstrated view simultaneously the stereoscopic radiograms. This is possible with the modified Wheatstone instrument, by placing a reversed pair of mirrors above the usual pair; but by this method one person sees the image in "false" stereo.

It is the purpose of this paper to describe a new type of stereoscope and to set forth its particular advantages over the types now in use.

The construction is based on the principle of all double-mirror stereoscopes, with the exception that the mirrors are mounted horizontally instead of vertically, and that the mirror stand is the only adjustable part.

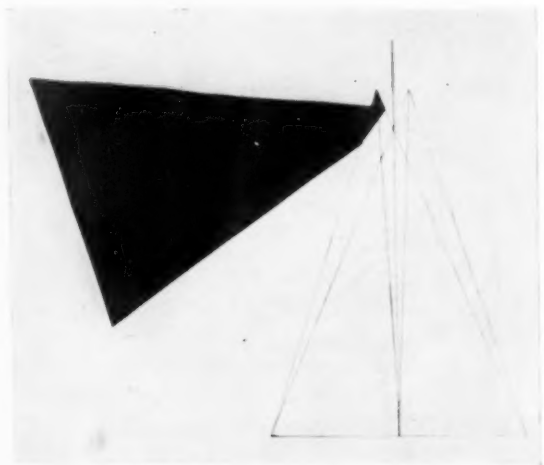

FIG. 2. Paper triangle superimposed on triangle of same dimensions and then folded, the line along the fold forming the plane of one mirror.

If the usual type of illuminating box is used, in which the fronts of opal glass are perpendicular to the support table, the horizontal mirrors can be placed midway between the boxes. The distance from the mirrors to each box should be 2 or 3 in. more than the usual plate-target distance employed.

If it be desired to incline the fronts of the illuminating boxes so that plates can be leaned upon them, it will be necessary to employ exact measurement of angles and distances; and the following procedure is recommended:

Using any suitable scale, erect a perpendicular at the mid-point of a basal line 18 in. in length. Now construct two acute-angled scalene triangles upon this line as a common base so that their apices are 24 in. from the point at which the perpendicular bisects the base,

and 1⅛ in. from the perpendicular line, or, in other words, the apices should be 2¼ in. from each other (the approximate average of the distance between the pupils of the eyes). Now cut two such triangles from paper and superimpose them over the triangles of the drawing, fixing the apices securely. To obtain the angles for the mirrors and light boxes, fold the paper triangles back along such a line as to bring the base of the folded triangle parallel to the shorter side of the opposite triangle of the drawing. The bases now form the position and angle of the illuminated side of the light boxes, and the lines of the folded portions of the paper triangles when projected to cross the perpendicular erected at the point of bisection of the base, form the angle at which the viewing mirrors should be set.

Light boxes may be constructed and so arranged that their ground glass illuminated surfaces coincide with the line of the bases of the triangles. Two plate glass mirrors, preferably 5 by 16 in., are fastened on a holder so that they form the angle laid out above for them.

It has been found desirable to have the light boxes placed upon a table of such a height as to permit the study of plates while seated. This simplifies the construction of the mirror support and its adjustments, as it is necessary to have a single tubular support to allow for rotation, as well as for elevation of the mirrors. This can be done by having a support work in a friction holder placed either on or under the table at a point equidistant from the bases of the light boxes.

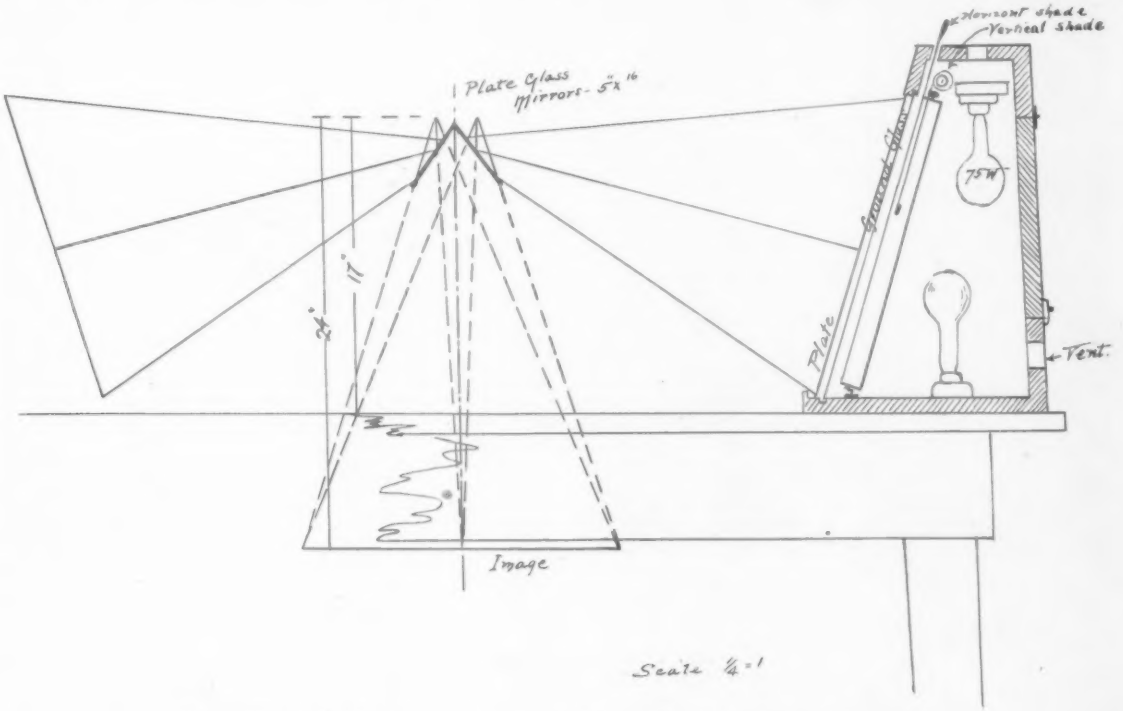

FIG. 3. Diagram of each step in construction and plan of completed stereoscope.

An advantage in the construction of the light boxes is placing the curtains inside the box and employing a rheostat control for the illumination.

Two persons may now view the plates in "stereo" by occupying seats on opposite sides of the table, and when adjustment has been made for one it will be found agreeable for the other.

We wish to bring out the following points in connection with this type of stereoscope:

1. Economical and simple construction.
2. Comfortable position while viewing plates, with the advantage of a table for notes or dictaphone.

3. An aid to persons using bifocal lenses, as the position of the head need not be changed to look through the lower lenses.

glass of the light boxes provides such a support that films or plates do not fall forward.

In conclusion, we should like to state

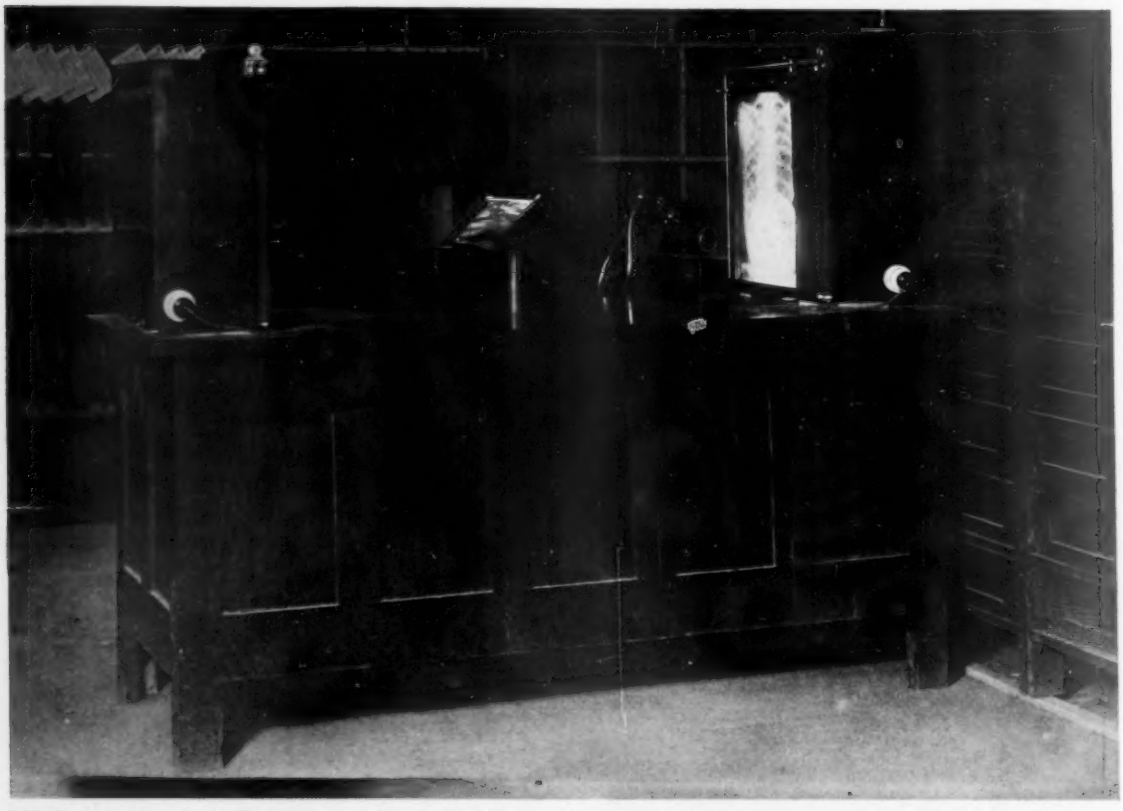

FIG. 4. Temporary stereoscope now in use. This one has vertical light boxes, but proves satisfactory in every way, and brings out all the principles set forth in this article.

4. The mirrors need only to be adjusted to make the images coincide.

5. Two persons may simultaneously observe a "true" stereoscopic image.

6. The inclined position of the ground

that this new type of stereoscope was designed and used by Dr. James G. Van Zwaluwenburg, but that his untimely death prevented him from bringing it before the profession.

A NEW SAFETY DEVICE*

BY H. W. VAN ALLEN, M.D.

SPRINGFIELD, MASSACHUSETTS

APPLICATION of *x*-ray, in the practice of medicine, changes so rapidly that many customs and usages that were perfectly safe only a short time ago have, due to the increased efficiency of our present day apparatus, become dangerous to a degree not always recognized. It is well known that a number of deaths have occurred from the application of the high tension current to the body. Every effort should be made to eliminate such dangers.

It is only a few years since many of us were treating cases with static machines, our belief being that, ordinarily, the current could not do material harm. We shortly transferred our treatment cases to the coil of the Rhumkoff type with the rheostat control, and still later to the transformer containing the rheostat control. Up to this point, due to the tendency of the rheostat not to allow large currents to pass suddenly through it, we were still within safety. This was all changed when we began to use the auto transformer control. Provided the patient had a good ground connection and the secondary current passed through a vital part of the body, death would be very apt to occur.

At the recent Washington meeting many safeguards were urged upon the roentgenologists.

Position of circuit breaker when treatment is progressing—current passing.

Position of circuit breaker after patient has pressed bulb—no current passing.

I wish to present to you, to-night, an additional device, which, while it is simple, is effective in stopping at once the continuance of the current, and places the control of the high tension, in an emergency, in the hands of the patient as well as the operator. At times the patient has an intimation of trouble before it actually occurs, and the loss of time calling the attention of the operator might be fatal.

I have, for a number of years, given patients a push-button connection with a call-bell, instead of trusting to hearing them speak, so that, if they are uncomfortable, they can give the alarm in this

* Read before THE NEW ENGLAND ROENTGEN RAY SOCIETY, Nov. 12, 1921.

way. Of course the wire connected with this push-button made an excellent ground which was undesirable. Since using the high tension currents this danger has become much greater.

Many of the machines are now made with circuit breakers, as all should be.

It is a combination of these two ideas which is involved in the little instrument presented. An ordinary one-pole circuit-breaker, which may be adjusted to act upon comparatively small currents, is seen at the left of the small switch-board. As some operators wish to use the same machine for roentgenographic work as well as roentgenotherapy and would not wish to reset the circuit breaker, a small switch is added above, which, when thrown in, cuts out the circuit breaker and makes large currents possible. At the lower right side is an ordinary electric bell to which has been added a special device which trips the circuit breaker. A pair of wires, in one of which is introduced two dry cells, extends from the bell to a position near the couch on which the patient is to be treated. At the end of these wires a specially constructed contact is seen, which is operated by air pressure. This latter arrangement prevents grounding of the patient through the wire and switch-board. To operate this air push-button the patient is given a rubber bulb to which is attached a few feet of rubber tubing which is connected with the air push-button. The slightest pressure on the bulb, by the patient, closes the air contact, throws the circuit-breaker and rings the bell continuously.

The advantage is manifest: the patient controls the high tension current, is able instantly to attract the attention of the operator, and is given a great sense of security. In actual practice, the device is not used unnecessarily by the patient.

TIME-SAVING DEVICES FOR THE ROENTGEN-RAY TREATMENT OF RINGWORM AND FAVUS OF THE SCALP

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THE Kienboeck-Adamson method of dividing the scalp into five areas in preparation for roentgen-ray therapy is now well established, and it is employed by nearly all roentgenologists and dermatologists when treating ringworm or favus of the scalp.

The usual procedure is to place a steel tape-measure over the top of the scalp, in the middle line, from the forehead to the nucha. Marks are made upon the scalp 10 inches apart. These marks will be usually about an inch inside of the anterior and posterior hair lines. Their exact positions in respect to the hair lines will depend upon the size of the head. A third mark is made exactly halfway between the other two. Marks are then made about one inch above the pinna of each ear. With the aid of the tape measure these marks are placed or adjusted so that each mark is 5 inches from neighboring marks. Connecting lines are then drawn between the various marks. In this way the scalp is divided into 5 triangular areas of equal size. The marks or points are the targets for the direct rays while the lines help in establishing the correct angles of incidence. As is well known, it is essential to have each of the 5 exposures at right angles to the exposures made to neighboring areas.

Heads, because of age, sex, race, etc., differ somewhat in both size and shape. This makes no material difference in the results obtained with the Kienboeck-Adamson method of preparing the scalp for roentgen-ray treatment (see below). It does, however, make it difficult to construct an instrument or marker that will instantly and accurately indicate the Kienboeck-Adamson points and lines on any head.

The circumference of the head of the average tinea tonsurans patient is 20 inches, providing the circumference is obtained from points in the sagittal plane, 1½ inches inside of the anterior and posterior hair lines and from points one inch above each pinna. Measured in this manner, the heads of some children show a circumference of 21 inches, while in others the circumference is only 19 inches. The circumference of adult heads, free of hair, is usually about 22 inches.

When preparing a head for roentgen-ray treatment one does not need to note the location of the circumferential line in relation to anatomical landmarks. It makes no difference whether the Kienboeck-Adamson points are on the anterior and posterior hair lines or a considerable distance inside of the hair lines. The lateral points may be an inch or more above the ear, or very close to the ear. The chief requisites are to have the points 5 inches apart (see below) and so placed that lines drawn between these points are at right angles. As a rule, it is possible to have the marks 5 inches apart, but this is not always so. In small heads the marks will be 4¾ inches apart, while in large heads the distance will be 5¼ inches or even 5½ inches. This variation of distance between the Kienboeck-Adamson points does make a difference in the dose received at any spot between the points, but this difference can be corrected by changing the skin-target distance. This question will be discussed later. For the purpose of developing a marking device it is necessary to establish a circumferential line such as mentioned in the previous paragraph.

The instrument or marker herewith described has been used by us for some time, and it has given admirable service in ways that will be mentioned later. It can be made by the operator out of an ordinary flexible steel tape-measure. The marker is simply a duplication, in metal or other material, of the Kienboeck-Adamson points and lines. The base is a circular band to which are attached two cross-pieces. The ends of the cross-pieces are riveted or otherwise securely fastened to the circular band at the anterior, posterior and lateral Kienboeck-Adamson points. The intersection of the two cross-pieces is also riveted: this represents the central or vertex Kienboeck-Adamson point. A glance at the photograph of the marker will show that the cross-pieces are set at right angles to each other and at right angles to the circular band. When constructing a home-made marker, it is advisable to join the cross-pieces to the base in such manner that measurement begins at the lower border of the latter.

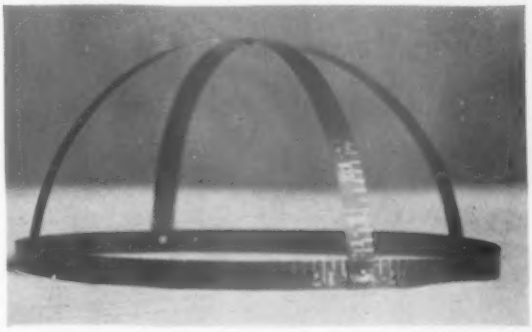

FIG. 1. Home-made tinea-marker. Made of steel tape-measure. Circumference, 20 inches.

For children, the marker is made in three sizes. The one that is used by far the most has a circumference of 20 inches and the Kienboeck-Adamson points are 5 inches apart. For smaller heads the circumference is 19 inches and the points are 4¾ inches apart. For the larger heads the marker has a circumference of 21 inches and the points are 5¼ inches apart.

When treating heads with a circumference of 19 inches it is advisable to use a skin-target distance of 6½ inches in order to avoid too much overlapping. When the head is smaller than this, it is advisable to reduce the dose from the standard skin unit to ¾ of a skin unit. Heads with a circumference of 20 inches or over are treated with an 8 inch skin-target distance, and a full skin unit is administered. Adult heads with a circumference of 22 or more inches may rarely require 1¼ skin units or even a larger dose. We have never found it necessary to use a skin-target distance greater than 8 inches; nor have we ever found it necessary or advisable to use 7 instead of 5 areas as advised by the Germans. The spark-gap length is 6 inches, so

that, even in very small heads, the distance between patient and tube terminals is greater than the length of the spark-gap.

It is possible to construct an instrument possessing adjustable joints so that one instrument can be adjusted to a head of any size. To do so, however, invites inaccuracy and the adjustments would require as much time as it would take to mark out the scalp by the old method. We greatly prefer a set of four markers—three for children and one for adults.

FIG. 2. Tinea-marker (home-made variety) placed in proper position on scalp.

A very skilful physician or technician can work with surprising accuracy without the aid of the Kienboeck-Adamson points and lines, but to do so is to take an unnecessary and unjustifiable risk. One should never fail to use or do anything that adds to accuracy, certainty and safety in *x*-ray work.

After the scalp hair has been closely clipped, it requires from ten to thirty minutes to mark out a scalp by the old method. The time consumed will depend upon the skill of the operator, the shape and size of the head, and, above all, the behavior of the patient. It is exasperating to a busy physician to waste a half-hour with a refractory child preparing the head for treatment. Furthermore, this fussing makes an apprehensive child so nervous that the treatment can be given only with considerable difficulty.

FIG. 3. After the scalp has been mapped out with the tinea-marker and an indelible pencil, and the marker removed.

It requires not more than sixty or ninety seconds to map out the scalp with the tinea marker. The child, instead of being apprehensive, is rather amused and interested. The instrument is used as follows: The patient's family should be instructed to have the patient's hair cut very close to the scalp. Hair clippers should be used. The marker is then placed on the scalp with the anterior and posterior points in the middle line and at equal distances inside the anterior and posterior hair lines. A line is then drawn on the scalp along the inferior border of the circumferential band. Lines are also drawn along the cross-pieces. Dots are made at the intersecting points. The marking can be done with a skin pencil, with ink or with a dull-pointed indelible pencil that has been moistened with water. In the case of a very dark skin, white ink is advantageous. Iodine or other

irritating chemicals should not be employed for this purpose.

Recently we have improved the "tinea-marker." The new instrument is made of celluloid. The circumferential band and the cross-pieces are of sufficient width to allow a slit in the center for nearly their full length. These slits represent the Kienboeck-Adamson lines, while holes, placed at the intersections of the cross-pieces and the circumferential band, represent the Kienboeck-Adamson points. In other words, the instrument is a stencil. It is placed on the head and painted with ink or chalk mixture; or the marking may

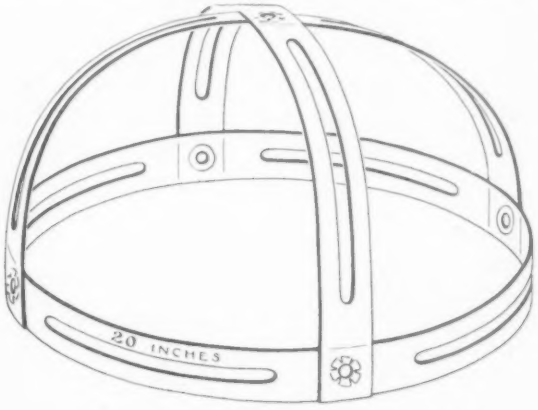

FIG. 4. Tinea stencil made of celluloid.

be done with a wet indelible pencil. When the stencil is removed, the head is ready for treatment. This instrument is manufactured in sets of four and it is now on the market. It can, of course, be made of metal. In either case it is easily sterilized.

Someone undoubtedly will suggest that the instrument be left on the scalp during treatment, thus obviating the necessity of making the marks and lines. This scheme has been tried and found wanting. No time is saved by so doing, because it is necessary to fasten the marker to the scalp with court-plaster; otherwise it is likely to slip out of position during the treatment.

Sparks from lead or other metallic substances, used for the purpose of protecting the non-hairy parts, may possibly ignite the very combustible celluloid.

Even thin celluloid may effect sufficient filtration to reduce the dose and prevent epilation; thus bands of diseased hair will remain to cause reinfection of the entire scalp. This undesirable result may be overcome by using filtered radiation. Coolidge has recently demonstrated, with very delicate and accurate ionization measurements, that there is considerable variation in the output from different standard Coolidge tubes operated under identical electrical conditions. The difference in intensity is due to variations in thickness of the glass walls of the tubes. Working with a 9 inch gap he found an extreme difference of 66.5 per cent with unfiltered radiation and 12.9 per cent with 3 mm. aluminum. This perturbing finding naturally encourages the use of filtered radiation. It is also possible that the difference between the amounts necessary to effect a temporary and a permanent defluvium is a little greater with filtered than with unfiltered radiation. It would seem, then, that filtered radiation should be the method of election. The results obtained in practice, however, do not yet support this contention, although further experience may do so.

Severe systemic reactions often follow the use of filtered radiation for this purpose. They hardly ever occur subsequent to unfiltered treatment. The brain, even of infants, has never been injured when unfiltered radiation has been used. Whether or not filtered radiation will injure the brain when employed for this purpose is not known. Buschke, Kleinschmidt and Gutmann report severe systemic reactions, and Buschke and Klemm report not only these, but also radiodermatitis, permanent alopecia and failure to depilate with filtered radiation in a large portion of their cases.

We have depilated over 1,000 patients with unfiltered radiation; always with certainty, never with untoward results. The work has been done with 8 or 10 different Coolidge tubes. This result shows a margin of safety sufficient for practical purposes. In fact, the margin of safety in practical work must be considerably greater than has been suspected. Hazen, Lane, and Fox and Anderson in this country and many English and French dermatologists and roentgenologists report similar results. Filtered radiation may prove to be superior to unfiltered radiation

for this purpose, but our advice is to make the change from unfiltered to filtered radiation cautiously.

The scalp is often irradiated for diseases other than tinea—psoriasis, eczema, acne varioliformis, etc. In such instances one does not desire to effect depilation, so that the dose is never more than ½ skin unit in one month. When treating the

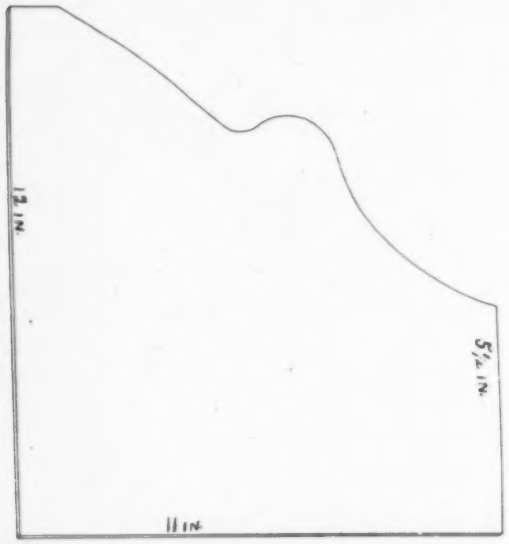

FIG. 5. Lead-rubber shield for side of face, ear, side of neck and shoulder.

entire scalp it is usual to employ the Kienboeck-Adamson angles, and because of the small dose it is permissible to estimate the Kienboeck-Adamson angles and points visually and without actual measurement. If, however, one desires to do so, the "tinea-marker" may be used for this purpose by placing it upon the head and leaving it there during the treatment. The filtration occasioned by the celluloid is not a serious matter in these diseases. A metallic marker is not suitable for this purpose. With celluloid one must be cautious about sparks. The circumference of adult heads, depending upon the amount of hair, varies from 22 to 26 inches. Special markers would have to be made for the large heads. We prefer to estimate the Kienboeck-Adamson angles and points with the eye or with a tape-measure when administering generalized irradiation in subepilating doses to the scalp for the treatment of such diseases as psoriasis.

The second time-saving device consists of a set of three "lead rubber" shields for the purpose of protecting the face, neck and ears during treatment. This scheme is not original with us. We first saw the shields used by Dr. A. Howard Pirie many years ago.

One square yard of "lead rubber," 3 mm. thick, is cut into three pieces. The exact

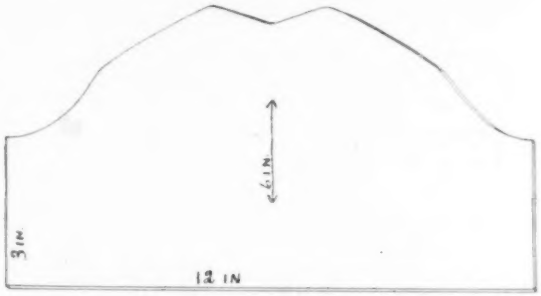

FIG. 6. Lead-rubber shield for forehead and face.

shape of each piece is depicted in the accompanying illustrations. One shield is for the face, one is for the side of the neck, shoulder and ear, and the third is for the back of the neck, the shoulders and the back.

The advantages of these shields are numerous. One of the greatest causes of

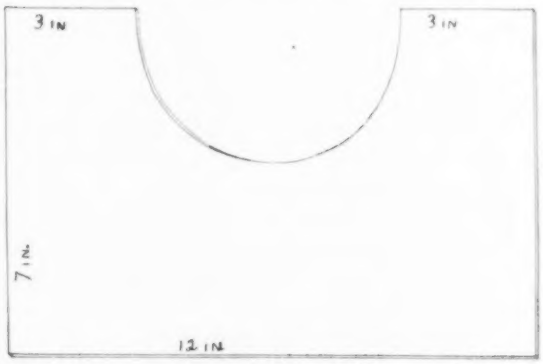

FIG. 7. Lead-rubber shield for back of neck, shoulders and back.

nervousness and restlessness during treatment is the sparking from lead foil. Much time is lost reassuring and quieting the patient; also time is lost in attempting to prevent sparking by obtaining good contact with the skin or by placing pads under the lead foil. The lead is likely to slip every time the head moves a little and the treatment must be interrupted while the

lead foil is again adjusted. Shields made of lead foil do not last long and it is a nuisance to have to make new shields so often.

We have never noticed sparking from the "lead-rubber" shields. Patients never complain. The shields are easily sterilized and are always ready for use. They can be placed in position in a second. They seldom slip out of position during treatment, but if they do, readjustment can be made in a second without interrupting the exposure. They afford ample protection and they will last several years. We feel that the "lead-rubber" shields directly and indirectly save a great deal of time. The shields will be found useful when treating diseases of the scalp other than tinea. They are now on the market.

Ten or twelve years ago, working with a gas tube, induction coil and pastilles, it often required a half day to depilate one head. The advent of the Coolidge tube and the interrupterless transformer reduced the time to an hour or two. Routine treatments are now given in from fifteen to thirty minutes. Several patients can be treated in one afternoon without mental or physical fatigue to the operator.

In conclusion we thank Dr. John Remer, Dr. F. Steinke and Dr. V. A. H. Cornell for trying the "tinea-marker" and the shields on a large number of cases. All who have tried these time-saving devices dislike to work without them.

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A MARKER FOR IDENTIFYING RIGHT AND LEFT EYE IMAGES IN STEREOSCOPIC CHEST FILMS

BY PAUL C. HODGES, M.D.

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Snook, writing in the American Journal of Roentgenology, January 1919, vi, No. 1, p. 39, discussed the principles of the formation of true and pseudo stereoscopic images, and described a simple method of marking films to show how they should be placed in the stereoscope to produce a true image. His method consisted in the use of a one inch wooden cube containing a metal brad. This cube was placed at one corner of the film-changing tunnel and left there during the exposure of both films. The variation in the appearance of the shadow of the brad, due to the shifting of the tube, determined which film was the right and which the left eye image. I have developed a slight modification of the method, for use with a vertical film-changing device, such as is used in making stereoscopic chest films.

In the particular film changer used in this laboratory, the window consists of a piece of transparent celluloid, 45½ cm. high, 44½ cm. broad and 3 mm. thick A point is selected 7½ cm. above and 6½ cm. to the left of the lower right hand corner of the window. Using this point as a center, a circle 2 cm. in diameter is inscribed on the celluloid. Two cork discs, each 8 mm. thick and 2 cm. in diameter are made, and fastened to the celluloid at the site of the inscribed circle, one disc being cemented to the front, the other to the back of the window. Either glue or acetone may be used as cement. After the cement has dried a few hours, a small hole is drilled through the center of the corks and the intervening celluloid, using a drill slightly smaller than the shank of a shingle nail. A shingle nail is now cut off at the point, leaving the head and 18 mm. of the shank. This is driven through the holes in the corks from behind until the head is flush with the rear cork. This gives essentially one of Snook's cubes, permanently fastened at the lower right hand corner of the

celluloid window, at a point where its shadow will be visible on 14 × 17 films, in either the vertical or horizontal position.

In practice, we fasten the patient's lead *x*-ray number to the celluloid, just below the cork, using for this purpose a bit of adhesive plaster. This done, it is possible to forget the films until they have been developed, dried, and are ready for examination, when we proceed as follows:

FIG. 1. This shows what is meant by the *back* and *front* of the stereoscope boxes. The shadows of the lead number and the marker are seen at the *front* in the left eye image and at the *back* in the right eye image.

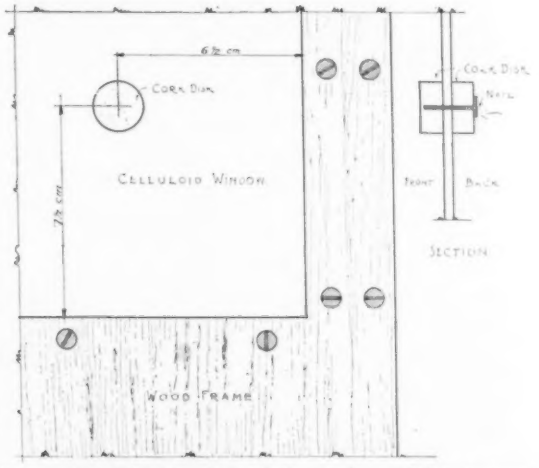

FIG. 2. A marker for identifying right and left images. Diagram showing section from lower right-hand corner of vertical film changer. The small diagram at the right shows a small section of the celluloid window, viewed from the edge.

The two films are arranged, one on top of the other, with the skeletal shadows in the erect position, and the numbers reading in order. It will be seen that the shadows of the numbers and the nail are in the lower right hand corner. The films are now turned over (because the stereoscope mirror reverses the image), so that the numbers read backward, and also turned sidewise, so that the skeletal shadows lie as though the patient were in the horizontal position (because the tube shift is vertical). We now have two films, each with the body in the horizontal position, with the numbers reading backward, and with number and marker in the upper left-hand corner. To determine which film is to go in the right-hand illuminating box and which in the left, one must examine the markers more closely. Doing this, it is seen that in one film the shadow of the nail is longer than in the other, and is angulated through a wider arc. This film is placed in the left-hand viewing box with the number at the front of the box; the other is placed in the right-hand box with the number at the back.

With the films so arranged, it is observed upon stereoscoping that we are looking through the chest from behind, forward; that the heart is on the left side; that the numbers read in order; and that the lead number strip appears farther from the observer than does the body of the patient.

There is one further step. Upon removing the films from the viewing box, a hole is punched in the upper posterior corner of each, so that on subsequent examination, it is merely necessary to turn the films over, so that the numbers read backward, turn them sidewise until the numbers are at the top, and then place them in the boxes with the punch marks at the back; that is, away from the observer.

A NEW METHOD OF SIMULTANEOUS STEREOSCOPIC OBSERVATION OF BOTH MASTOIDS

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HILL and Thomas, writing in the *American Atlas of Stereoroentgenology*, February, 1911, ii, No. 8, described a technique for making stereoroentgenograms of both mastoids on a single pair of plates. Their method made it possible to stereoscope right and left mastoids simultaneously, and was consequently of great diagnostic value.

The general use of films instead of plates makes possible another method of simultaneous examination of the two sides, which I have employed for about two years and which I find to be much simpler than the older method.

Stereoscopic pairs are made of both mastoids, using 5 × 7 films and marking right and left sides. The films of the right side are placed in the stereoscope so that they give a true stereoscopic image; then, using a conductor's punch, holes are punched to show the upper corner at the back of the box. The films of the left side are prepared in the same way.

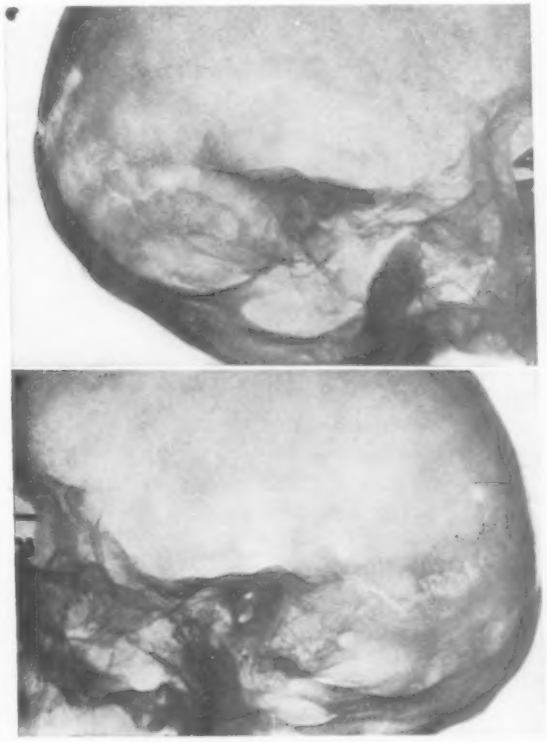

FIG. 1. Right Eye Image. Roentgenograms of dried skull. Right side above, left side below, punch marks of both films at the left, numbers and letters reversed.

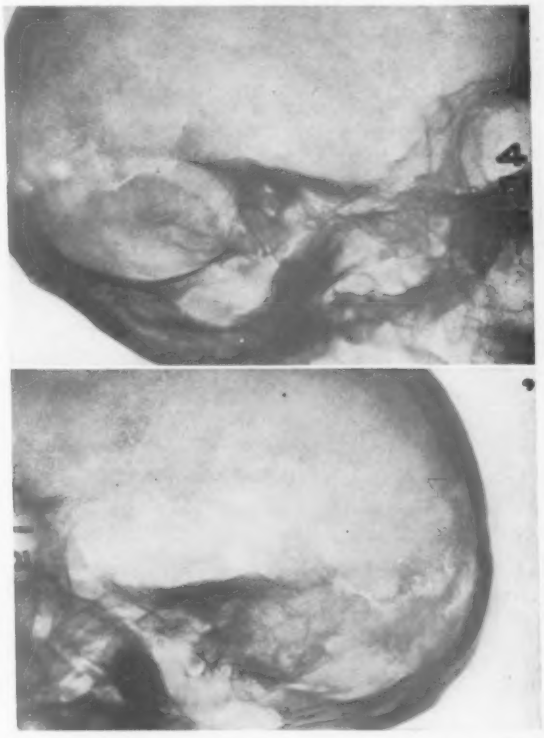

FIG. 2. Left Eye Image. Roentgenograms of dried skull. Right side above, left side below, punch marks at the right. Figures 1 and 2 can be stereoscoped in the ordinary Wheatstone stereoscope.

Next, 10 × 7 pieces of celluloid are prepared, using discarded films with the emulsion washed off. The films of the right mastoid are turned over so that the numbers read backward (because the stereoscope mirror reverses the image) and fastened to the upper half of the celluloid mount, using paper clips. It will be found that the punch marks are

located at opposite corners in the two films. The left mastoid films are now turned over so that the numbers read backward, and are fastened to the lower half of the celluloid mount, care being taken to see that the punch marks in the lower films correspond with those in the upper ones.

Two mounts are now ready for the stereoscope; in one the punch marks are at the left, in the other at the right. The mount with the punch marks at the *right* is the left eye image; in other words, the punch marks must be placed at the back of the box. The mounted films are now observed in the stereoscope to assure that the right mastoid is above, the left below, and that there is a true stereoscopic effect with the number farther from the observer than the shadow of the skull. If everything is in order, the films are permanently fastened to the celluloid with metal staples.

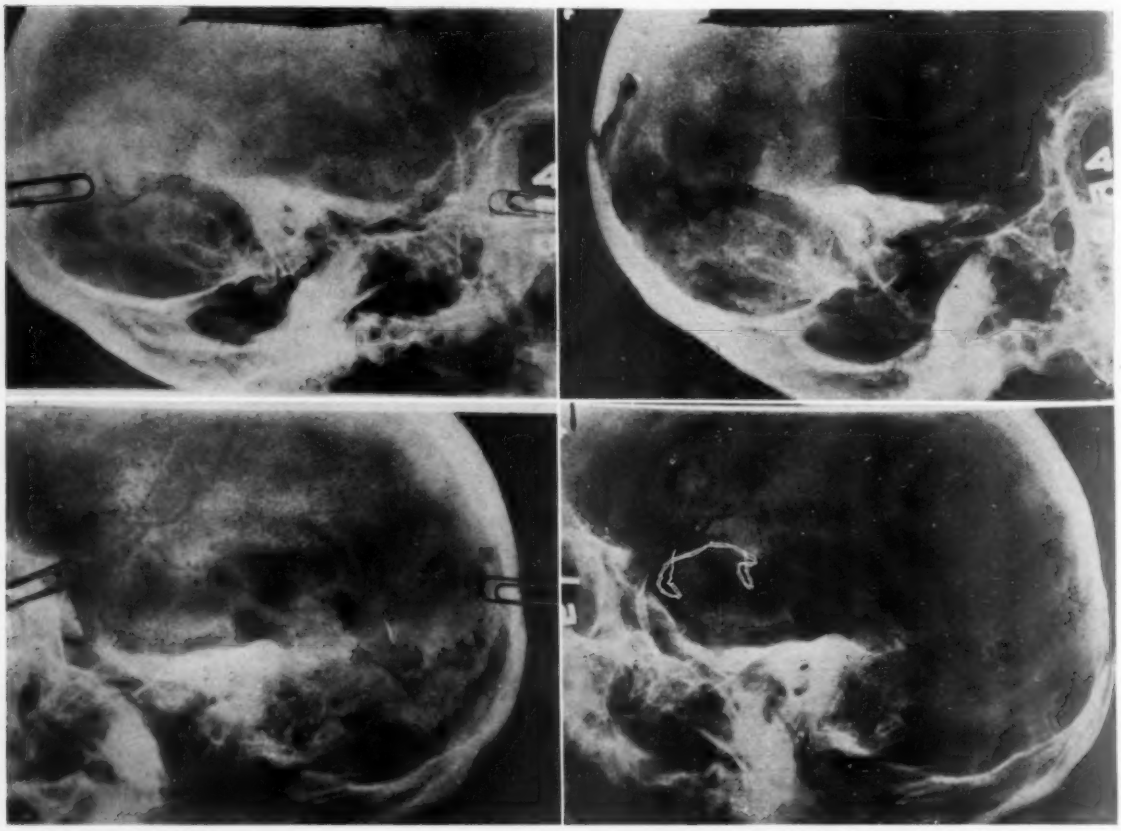

FIG. 3. Showing method of fastening films on celluloid mount. In the left eye image, the temporary paper clips are seen; in the right eye image, staples have been applied and the clips removed. It has been found unnecessary to use more than two staples; in fact, more than two are apt to cause buckling of the films. The curtains of the stereoscope boxes serve to hold the upper and lower borders of the films against the mount.

A NEW RADIUM APPLICATOR FOR THE TREATMENT OF CATARACTS

BY BUNDY ALLEN, M.D.

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THE application of radium in the treatment of cataracts has been simplified by the applicator, as shown in the following cuts.

The concavity of the applicator is made to conform to the convexity of the eyeball, and is easily and comfortably inserted. The construction of the applicator is such that it is held in place by the eyelids. The applicator, as illustrated, obviates the necessary tanning of the skin from the eyelid when applying the radium externally.

FIG. 1. Oblique view of applicator.
FIG. 3. Opposite end of applicator closed.

FIG. 2. End view.
FIG. 4. The under concave surface of the applicator.

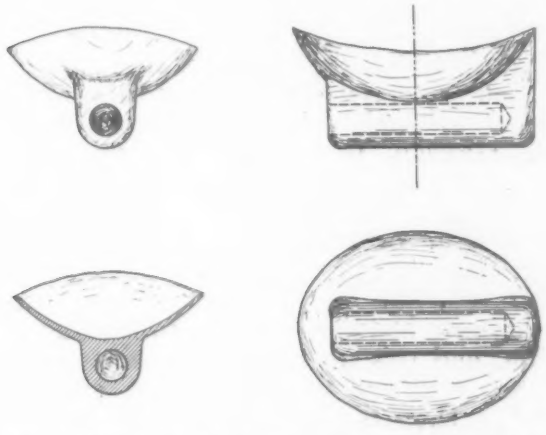

FIG. 5. Sketch of the applicator to show the position and method of filtering the rays.

A CASE OF TUBERCULOUS GINGIVITIS TREATED WITH APPARENT SUCCESS BY RADIUM*

BY GEORGE E. PFAHLER, M.D., AND B. P. WIDMANN, M.D.

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IN reviewing the literature, we find that tuberculosis of the oral cavity is comparatively a common condition. After a reasonable search, however, we have not been able to find any case recorded of radium therapy for tuberculous gingivitis. According to Levy, Thomae in 1838 made the first report of tuberculosis of the mouth. Since then much has been written and many cases recorded. Levy reviewed the literature of reports of 200 cases. We will not discuss here the pathology of this condition. Adami expresses the concensus of opinion that tuberculosis of the mouth is rarely a primary condition. Unlike many of the infections commonly found in the oral cavity, many of which are often attributable to bad teeth and uncleanliness, we find that this condition develops in patients who have observed oral hygiene most scrupulously.

Briefly, the notes on the case which we are reporting are as follows: Male, age 33, was referred to us by Dr. W. I. Galland, May 5, 1921. He had had pulmonary tuberculosis fifteen years before. He was in Colorado under treatment from 1915 to 1919. In the fall of 1916 an ulcer developed in the left side of the gum running along the outer side of the teeth, and in the spring of 1920 he noticed a spot developing over the right upper canine tooth. The diagnosis of tuberculous gingivitis was made by Levy of Denver, Col. The electric cautery and trichloracetic acid had been used without success. Gentian violet seemed to do some good. In 1918, under Levy, he received a course of tuberculin beginning at .000000001 gm. of O.T. and going up by graded doses to .7 gm. The lung condition improved, but there was a local reaction in the gum when there was a tuberculin reaction, and this kept the gum irritated. A section removed and examined by Dr. Galland showed the tubercle bacillus. This was confirmed by Dr. Eugene Case of the Department of Pathology of the Post Graduate School of Pennsylvania.

The lesions first appeared as small punctate areas scattered about the gum margins of the upper and lower canines and lateral incisors and the left lower molars on both labial and lingual surfaces. These soon blended, forming irregular, serpiginous lines extending well down over the surfaces of the gums and over a great area of the left cheek. The ulceration became progressively more definite and invading, remaining always fairly superficial with sharp, red, irregular borders, within which were interspersed soft granulations with pinhead spots of yellow and gray, and occasionally covered with cloudy films of dirty yellowish serum. There were much irritation and frequent pain.

The case having resisted all other forms of treatment, the application of radium was made as follows; a 10 mgm. plaque of radium covered with 1 millimeter of rubber was fixed to a wooden tongue depressor and was held firmly on as many areas as was necessary to cover all lesions. The time on each area was 20 minutes. Seven applications were made at intervals of three weeks. Special care was taken to guard against any local reaction or any destructive effect, and to keep at all times within the range of a stimulating dose. The actual dose given was between ⅓ and ½ of a skin erythema dose. After each seance the lesions grew paler, with less pain, until finally all signs of ulceration, irritation and pain had disappeared, September 22, 1921. To date, there has been no evidence or sign of recurrence.

All authors agree that these cases are most obstinate and resist all forms of treatment, such as excision, cautery, curettement, tuberculin and local medica-

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ments. Levy believes that tuberculous ulcers of the oral cavity rarely heal, though their progress is extremely slow.

We report this case, even though the duration of the results is short, because the results seem to be brilliant, and with the hope that others may at least try the obstinate cases.

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TECHNIQUE AND STATISTICS IN THE TREATMENT OF CARCINOMA OF THE BLADDER BY RADIUM*

BY B. S. BARRINGER, M.D.

NEW YORK CITY

DETERMINATION OF METHOD OF RADIUM TREATMENT

(I.) *Intravesical.* Growths confined to and around bladder neck. Small papillomata. Pedunculated papillary carcinoma if pedicle can be reached. Infiltrating sessile growths of no more than 2 cm. in diameter.

II. *Suprapubic.* Growths other than the above and without metastasis. Extensive infiltration of the bladder wall, large and multiple tumors are the indication for section, to which all doubtful cases are method in submitted.

TECHNIQUE

Intravesical Methods. By means of a flexible spring holder used through the sheath of the Brown-Buerger operative cystoscope 100 or more mc. of unscreened radium may be held up against the tumor for the period of half an hour while the tumor is being observed through the cystoscope. This may be repeated every two weeks, or less often if the tumor is disappearing satisfactorily. If the tumor looks solid or hard, or has a base which looks indurated, then we may treat it by thrusting into its base or the indurated part, a radium needle screened simply by the steel of the needle. This needle is also on a flexible spring and is used through the operating cystoscope. Needles from 50 to 200 may be used for a period of time up to forty minutes. We must remember that in this method the action is local and caustic. We have in a similar way implanted small bare tubes of radium into the base of a tumor and left them there. For this, bare tubes of 0.7 to 0.8 mc.[1] to a sq. cm. of tumor are used, and left in place. Of all the methods this has proved the most satisfactory. The action here is still more local and more caustic. We have used all of these methods and combinations of them in various tumors, and by all of them have destroyed small or recurrent carcinomata of the bladder. If a tumor is more extensive, if it is papillary in character, if the pathological examination shows pure papilloma, and especially if it be around the bladder neck, we often start the treatment by placing in the bladder two tubes of screened radium (.6 mm. silver, 2 mm. rubber). These tubes are inserted through the sheath of a straight cystoscope and tied with a string and left

[1] We have found that 0.7 to 0.8 mc. of radium produces no more irritation to the bladder than tubes of lesser strength, and produces more gamma radiation, and therefore is better.

* Read at the Seventh Annual Meeting of The American Radium Society, St. Louis, Mo., May 22–23, 1922.

in place for varying periods of hours and then pulled out of the urethra by the attached string. As a rule, we use two tubes of 50 mc. for five or six hours. The value of such radiation is first, to see how the tumor reacts to radium; second, temporarily to stop the bleeding to make cystoscopy possible; third, to destroy that portion of the tumor around the internal urethral orifice. If the tumor is carcinomatous and large, so that the incision may not go through tumor tissue. Between two clamps the bladder is opened and a 3 or 4 inch incision is made longitudinally. The cut surface of the bladder is grasped by clamps, the clamps being about 1 inch apart. The reason for this is that the bladder will otherwise collapse and fall down into the pelvis when retractors are put into it, thus making operation impossi-

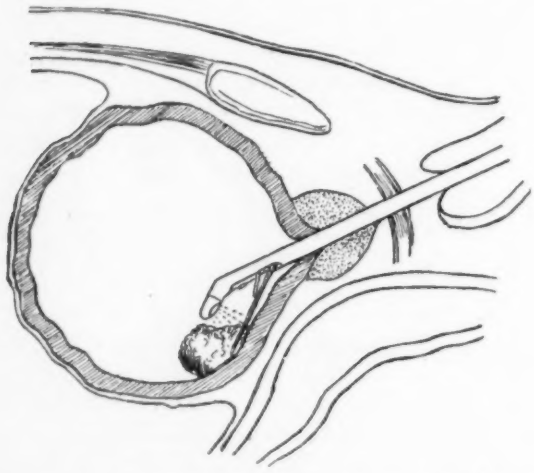

FIG. 1. Method of burying radium emanation tubes in growth by means of special introducer and the cystoscope.

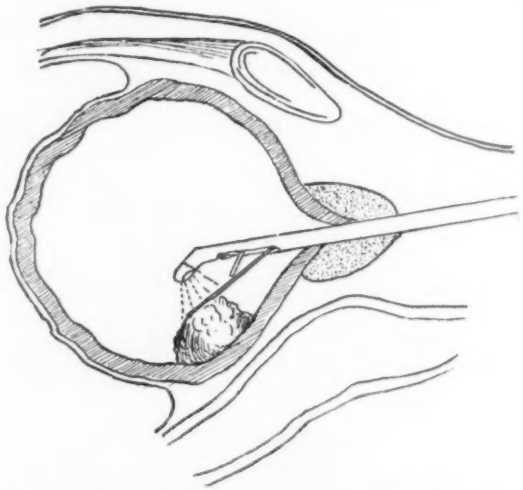

FIG. 2. Surface application of radium emanations to growth under vision by means of special applicator in cystoscope.

and we believe from our examination it is confined to the bladder, then we do the open operation described below.

Suprapubic Application of Radium in Extensive Carcinoma. Because we were unable to cope with extensive carcinomas of the bladder by the intraurethral method, in June, 1919, we began to open up the bladders in selected cases and implant radium directly into the carcinoma. The technique is as follows:

Gas and oxygen anesthesia is used. The bladder is prepared by washing and filling with a 1:4000 acriflavine solution. The patient is placed in Trendelenburg's position. The skin incision is a long one, extending from the symphysis to the umbilicus. The prevesical fascia is cut transversely at the symphysis and dissected back, the bladder being exposed well down its posterior wall. The urachus is cut, and the exposure extends beyond this. The sides of the wound are screened with gauze. The bladder is gently palpated ble. A light is thrown into the bladder, and bladder retractors, three or four in number, are gently placed in the bladder. The retractors which we have used most have been made for us at the Memorial Hospital. They are made of ⅛ inch steel wire in the form of an open loop. The advantage of these is that the tumor may be seen through the open portion of the retractor, and treated. The tumor being exposed is sponged as little as possible to prevent bleeding and spreading of tumor cells. Any protruding portions of the tumor are snared off, using a simple wire snare. If the tumor is flat and not papillary in type, none of it is removed. The reason for snaring off the papillary part is better to expose and treat the base. Indurated parts of the tumor are implanted with radium bare tubes (0.7 mc.) by means of a needle, using one of these to the sq. cm. These bare tubes are put in to the extreme edge of the tumor.

The bladder is filled with 60 per cent alcohol after the method of Beer (three

minutes) in order to kill any stray tumor cells and prevent implantation. The bladder is closed up with plain catgut, and usually drained with a small rubber tube.

STATISTICS

To determine the value of radium removal of bladder carcinoma we have attempted a comparison between radium and operative removal. This comparison is made in three ways:

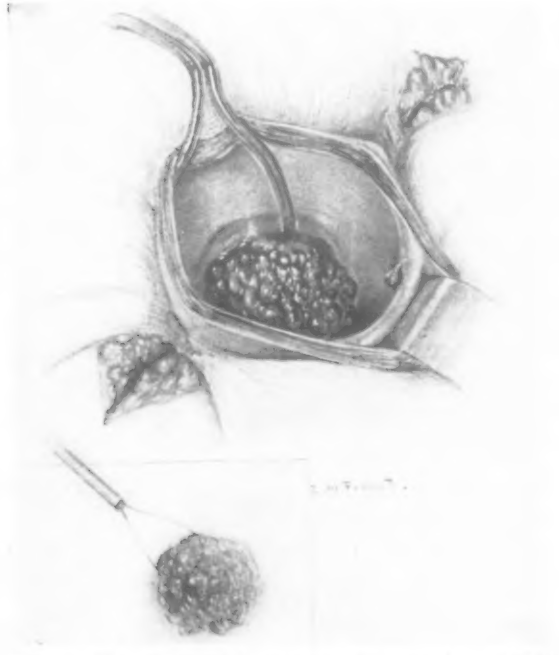

FIG. 3. Use of special retractor in exposing clearly the carcinoma, especially its base. Snaring off pedunculated growth preparatory to burying radium emanation tubes in its bore.

1. Giving radium results in operable cases.

2. Giving radium results in inoperable cases.

3. Giving the results in cases in which operation is used as an adjunct to radium. That is, the tumor is exposed by cystotomy in order to implant radium in its base. This last to compare the mortality, results, etc., of this procedure with the mortality and results of operative removal of carcinoma.

Any classification of operable and inoperable cases is, of course, arbitrary, and varies with the successes any individual operator may have had in different kinds of carcinoma. We have put in the inoperable class, carcinomata in which successful removal by operation alone was highly improbable, namely:

1. Multiple carcinomata or large carcinomata of a base more than 4 cm. in diameter.

2. Carcinomata which have affected the trigone and posterior urethra.

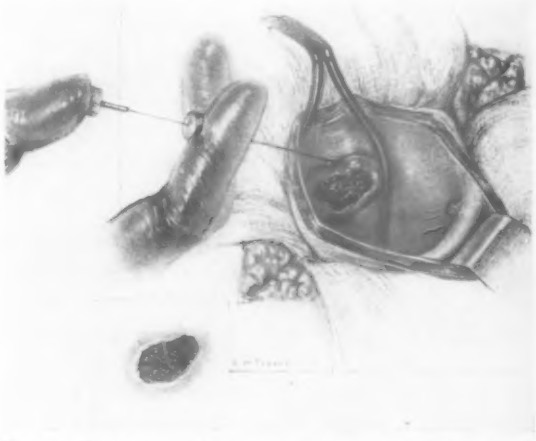

FIG. 4. Burying radium emanation tubes under direct vision after exposure of carcinoma by suprapubic cystotomy.

3. Carcinomata which have previously been operated upon and have recurred.

4. Carcinomata in patients whose age or condition contraindicated shock of operable removal.

Gross Pathology of Tumors. The characteristics of the 10 operable and 20 inoperable tumors below described are as follows:

Multiple	8
Indurated base	18
Involving ureter	5
Involving trigone	8
Involving bladder neck	12
Lateral wall	6
Vault	1
Grown through bladder	1

SMALL OPERABLE CARCINOMA[2]

Ten cases, (1 of these a borderland case). Carcinoma removed,[3] 8 cases (proved by cystoscopy). Dead 2:

[2] Complete tables of these cases are appended at the end of this article.

[3] We have insisted upon the cystoscopic proof of removal. Simply to say that a patient looks and feels well for a year or two after an attempt at removal of bladder carcinoma, means little.

On 1 cystoscopy	1 case.
6 mo. to 1 yr.	4 cases.
1 yr. to 2 yrs.	2 cases.
4 yrs.	1 case.

Pathology:

Papillary carcinoma	2
Carcinoma	2
Epidermoid carcinoma	2
Squamous carcinoma	1
No pathology	1
Total	8

One died two years after radium from growth in seminal vesicle. Possibly it was primary there. One died three months post-cystotomy (before operation had 5 per cent sugar in his urine).

Removal:

Intravesically	7
Suprapubically	1

Complications:

In one patient, the kidney which corresponded to the side on which the tumor was situated, was non-functionating, and draining pus into the bladder. The patient has gone five years since the removal of his tumor. He has, in addition, an enlarged prostate, with residual urine, and a diverticulum.

Summary. In 8 of 10 operative cases (80 per cent), the carcinoma has been removed from the bladder. The two patients who died, lived two years and three months respectively after they were first seen. This is, perhaps, too small a number of cases upon which to base conclusions, so we now turn to the inoperable cases for confirmation.

INOPERABLE CARCINOMA OF THE BLADDER

In this class are recorded only the cases in which the carcinoma has been removed by radium.

Carcinoma removed, 20 cases (proved by cystoscopy):

1 mo.	1 case.
6 mo.	4 cases.
6 mo. to 1 yr.	2 cases.
1 yr. to 2 yrs.	9 cases.
2 yrs. to 3 yrs.	3 cases.
3 yrs. to 4 yrs.	no cases.
4 yrs. to 5 yrs.	1 case.

Another case, not reported above, is well eighteen months post-radium, but refuses cystoscopy. One of the above cases has an extra-vesical extension of carcinoma, to which he will succumb. One had a recurrence two years post-radium treatment. This was removed by radium, and she has been well one year. Two have had slight recurrences (one year after removal) at the interior urethral orifice (still treated). One died one year and two months after the first radium treatment from a sloughy, infected bladder, due to radium burn.

Pathology:

Carcinoma	2 cases.
Papillary carcinoma	2 cases.
Infiltrating carcinoma	6 cases.
Epidermoid carcinoma	1 case.
Papilloma	2 cases.
Squamous infiltrating carcinoma	1 case.
Carcinoma (?)	1 case.
No diagnosis	5 cases.

Removal:

Intravesically	10 cases.
Suprapubically	10 cases.
Previously operated upon	3 cases.

Summary. In 20 inoperable cases of bladder carcinoma, the tumor has been removed from the bladder. In 3 cases, the carcinoma has recurred after removal. In 1 of these 3, the recurrence is beyond the bladder; the other 2 are being treated. One is dead from radium slough of bladder.

Let us briefly take the third point of comparison. At the Memorial Hospital we have, in carcinoma which was too large to attempt to remove intravesically, and in which we believed the carcinoma to be confined to the bladder, exposed the tumor by a cystotomy, to see if it were suitable for removal by radium. If, on exposure, a tumor is found to be too large for removal, the bladder is simply closed, and the removal of the tumor by radium not attempted. We are always attempting to extend the field of radium, and remove larger and larger tumors. Thus we almost invariably implant radium into

what we regard as hopeless tumors, to see if we cannot control them, even for a time. Thirty-five bladder carcinomas have been treated in this way. In but 2 of these cases might a tumor have been called operable. In 2 cases, the tumor was so large that the bladder was not opened, although radium was implanted in it.

In 12 of these 35 cases, the carcinoma had been removed from the bladder. Nineteen of these 35 are living. The deaths in this series were as follows:

1 mo.	none
1 to 2 mo.	1
2 to 3 mo.	1
3 to 6 mo.	6
6 to 12 mo.	4
12 to 24 mo.	4

I believe that the conclusion from this is, that in cases in which we could do no good, we probably did not appreciably hasten the demise of the patient. On the contrary, in some hopeless cases, we retarded the tumor's growth, lengthened the span of life and stopped bleeding.

Kidney Complications. Probably not a few of the postoperative deaths are due to kidney complications. We have found that 2 out of 3 cases of carcinoma of the bladder have a distinctly reduced kidney function. In the radium removal of bladder tumors we have made it our policy never to transplant a ureter, but simply to implant the radium into the base of the tumor, and deal with kidney complications which may arise subsequent to the operation. In but one case have we had a severe enough infection to demand opening the kidney. This was done under novocaine, and the patient subsequently died. Implanting the ureter likewise lengthens the operation.

The whole operation for the suprapubic implantation of radium into bladder carcinoma described elsewhere[4] takes considerably less time than operative removal of such tumors.

Let us now turn briefly to operative statistics. Scholl,[5] from the Mayo clinic, reports 94 cases of solid carcinoma of the bladder which were operated upon. Of these 94 cases, 67 (71.2 per cent) are dead after an average duration of life of seven and a half months and 27 (28.7 per cent) have lived an average of three years and three months. Twenty per cent of patients operated on for infiltrated carcinoma died during the first month after operation, as compared with no immediate postoperative deaths in radium removal.

Disadvantages of Radium. Much of our seven years' work with radium has, of necessity, been experimental. We have had radium burns; in 3 cases of extensive carcinoma in which the dose of radium has been too much, the patients died of sepsis, caused by radium slough. In cases in which a suprapubic operation has been done, the healing sometimes has been slow and protracted. All of these unfortunate results can and are being overcome by more accurate dosage and more accurate application of radium.

CONCLUSIONS

In 8 out of 10 operable cases of bladder carcinoma and in 20 inoperable cases the tumors have been removed by radium. Radium removal is superior to surgical, because it can cope with inoperable cases. If a suprapubic radium removal is necessary the time of operation is shorter and the kidneys are less disturbed by the operation. Postoperative or post-radium recurrences can be better dealt with. Many so-called operable tumors can be removed intra-urethrally without any operation.

[4] BARRINGER. Radium treatment of carcinoma of the bladder. *Ann. Surg.*, 1921.

[5] Histology and mortality in cases of tumor of the bladder. *Surg., Gynec. & Obst.*, Feb., 1922, xxxiv, 189.

INOPERABLE CARCINOMA OF BLADDER—TUMOR REMOVED BY RADIUM

No.	Name	Age	Date Treatment	Description of Tumor	Pathology	Intra-vesical	Suprapubic	Result	Previous Operation
1	V.	36	June, 1919	Papillary tumor, large as orange, base 5 × 5 cm., of left bladder base.	Papillary infiltrating carcinoma (Ewing)	..	×	Bladder clean (cystoscopy) 20 mo. post-op. (slight papilloma of urethra). Reports well 3 yrs. 2 mo.	One
2	K.	54	Jan., 1920	Papillary tumors, indurated base (largest 3 × 3 cm.) all around bladder neck.	.....	..	×	Bladder clean (cystoscopy) 24 mo. post-op.	0
3	W.	61	Mar., 1920	Solid tumor, ulcerated surface (6 × 6 × 6 cm.) on anterior wall of bladder growing through bladder, and adherent to pelvis.	.....	..	×	Bladder clean (cystoscopy) 24 mo. post-op.	0
4	H.	48	Sept., 1919	Number of hard nodules around bladder base. (Scar of radium in bladder neck from pre-op. treatment.)	Papillary carcinoma (Brooklyn Hospital)	..	×	18 mo. post-op. has slight urinary frequency (once at night). Looks and feels entirely well. Refuses cystoscopy.	One
5	G.	50	Apr., 1920	Solid flat tumor 3 × 4 cm., within 1 cm. of left ureter.	Infiltrating carcinoma (Ewing)	..	×	Recurrence after operation treated intravesically. Bladder clean (cystoscopy) Feb., 1921. Extra vesical carcinoma 23 mo. post-op.	0
6	D.	33	May, 1920	Solid tumor, left wall, 2 × 4 cm. Papillary tumors around bladder neck.	Infiltrating carcinoma (Ewing)	..	×	Recurrence after operation. Treated intravesically (3 times). Mar. 3, 1921., no tumor. Radium slough. Well 23 mo. post-op.	0
7	S.	55	July, 1920	Papillary tumor, 4 × 5 cm., of left bladder base. Base indurated.	Infiltrating carcinoma (Ewing)	..	×	Bladder clean (cystoscopy) 17 mo. post-op.	0
8	W.	50	Aug., 1920	Indurated ulcerated tumor, 3 × 3 cm., around sphincter of bladder.	Epidermoid carcinoma (Ewing)	..	×	Bladder clean (cystoscopy) 6 mo. post-op. Recurrence Jan., 1922. Still treated.	0
9	R.	70	Dec., 1920	Indurated, flat, irregular tumor, 3 × 3 cm., centering in left trigone and touching bladder neck.	Papilloma (Ewing)	..	×	Bladder clean (suprapubic observation) 2 mo. post-op. sinus 1 yr. 6 mo.	0
10	M.	50	Dec., 1920	Indurated ulcerating tumor touching internal urethra 4 × 3 cm.	Squamous infiltrating carcinoma (Ewing)	..	×	Well, no tumor, 15 mo. post-op. (Suprapubic sinus.)	0
11	T.	59	June, 1920	Flat irregular tumor around urethra (treated by radium before operation). Small tumor seen at operation.	Infiltrating carcinoma (Ewing)	..	×	No tumor 6 mo. post-op. Radium slough (cystoscopy). Died 1 yr. 2 mo. post-op. infection.	0
12	C. A. C.	69	Dec., 1915	Cauliflower non-pedunculated, sloughly, base 3 cm., over left ureter.	Carcinoma (Ewing)	×	..	Bladder clean 4 yrs. 4 mo. (cystoscopy). Well 6 yrs.	0

13	E. J. S.	54	July, 1916	Papillary tumor, sloughy, extensive, all around the bladder neck. Vaginal induration of 5 cm.	Papilloma (Ewing)	×	..	Bladder clean 1 yr. Well 4 yrs.	0
14	M.	70	Oct., 1916	Multiple, papillary, red tumor on bladder base, vaginal induration.	Carcinoma (Ewing)	×	..	Bladder clean 2 yrs., then recurrence. Removed by radium 1 yr.	0
15	R.	68	June, 1917	Sloughy papillary tumor, extensive, bladder neck.	Papilloma carcinoma (Ewing)	×	..	Bladder clean 3 mo. Recurrence. Bladder clean 1½ yrs. Well 2½ yrs.	0
16	P.	63	Nov., 1916	Two tumors, one sloughy, around bladder neck.	.....	×	..	Bladder clean, 2 mo.	0
17	S.	53	.....	Multiple sloughy tumors, bladder neck, largest ½ × 3 cm.	Carcinoma ?	..	×	Bladder clean, 5 mo. slough.	0
18	W.	58	Oct., 1921	Indurated tumor, bladder neck, 3 × 2 × 2 cm.	Infiltrating carcinoma	..	×	No tumor. Radium slough. 5 mo.	0
19	P.	45	Apr., 1921	Recurrent after operation. Small solid growth, 2½ × 1 cm. near left ureter.	Papillary carcinoma	×	..	Bladder clean, edema 8 mo.	One 0
20	D.	70	Sept., 1920	Left bladder base, sloughy indurated mass, 2 × 2 cm.	.....	×	..	Bladder clean 1 yr. Recurrence 1 yr. 7 mo. Still treated.	0
21	W.	38	Nov., 1920	Multiple sloughy tumors, base indurated, left bladder neck and urethra.	.....	×	..	Bladder clean 1 yr. 5 mo.	

SMALL OPERABLE BLADDER CARCINOMA, TREATED BY RADIUM

No.	Name	Age	Date	Description of tumor	Pathology	Intra-vesical	Suprapubic	Result	Previous Operation
1	W.	60	Apr., 1920	Pedunculated tumor (small tangerine) covered with incrustations, left bladder wall, indurated base.	Papillary carcinoma (Ewing)	..	×	Bladder clean (cystoscopy) 23 mo. post-op.	0
2	H.	62	July, 1916	Rapidly growing, flat, ulcerated, small operable near ureter.	Carcinoma (Ewing)	×	..	Bladder clean 4 yrs. (cystoscopy). (Kidney no function on side corresponding to tumor).	0
3	V. W.	59	May, 1917	Papillary tumor, some slough, left trigone, 2 × 2 cm.	Papillary carcinoma (Ewing)	×	..	Bladder clean once (cystoscopy) 1 yr. after treatment.	0
4	.....	.....	.....	Small ulcerated tumor of left trigone.	Carcinoma	×	..	Died 2 yrs. later, extension beyond bladder. Possibly primary in semi-vesicles.	0
5	G.	64	.....	Tumor, flat, ulcerating, right lateral wall, 2 × 3 cm.	Epidermoid carcinoma (Ewing)	×	..	No tumor 8 mo. later (cystoscopy). Radium burn. Well, Feb., 1922.	0
6	W.	50	.....	Small, ulcerating, flat, back of left ureter, 3 × 3 cm.	Epidermoid carcinoma (Ewing)	×	..	No tumor 8 mo. later (cystoscopy).	0
7	H.	50	.....	Red, smooth, rounded tumor, near right sphincter, 3 × 3 × 2 cm.	Questionable, if carcinoma	×	..	No tumor 1 yr. later (cystoscopy).	0
8	G.	..	July, 1921	Solid tumor back of left ureter 2 × 2 × 2 cm. Some slough.	Squamous carcinoma (Ewing)	×	..	Feb., 1922 (cystoscopy) slight slough at site of tumor. No tumor.	0
9	V.	45	Apr., 1921	Papillary red tumor, firm edge, 2 sloughy areas, left lateral wall, 3 × 2½ cm. indurated carcinoma.	0	×	..	March, 1922, no tumor. Slight slough at site of tumor.	0
10	E.	56	Aug., 1920	Sloughy flat carcinoma, right bladder wall, 3 × 3 cm.	Carcinoma (Ewing)	..	×	5% sugar in urine at time of operation. Died 3 mo. post-op. of perirectal abscess.	0

RESULTS OF TREATMENT OF CARCINOMA OF THE CERVIX WITH STATISTICS AND TECHNIQUE*

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THE further development of means and methods for combating cancer of the cervix uteri is perhaps the most pressing gynecological obligation of the profession today. The established relationship between chronic irritations and cancer gives basis to the hope that surgical prophylaxis in the treatment of tears and ulcers will reduce the incidence of cervical cancer. Watery and bloody vaginal discharges are associated with the idea of malignancy, not only in the minds of most doctors, but of most women. In spite of this, and of the complementary knowledge that the hopeful time to treat cancer is in its incipiency, it is nevertheless true that a large proportion of these patients come first for help in advanced stages of the disease. It seems quite certain, no matter what education may effect, that these advanced cases will continue frequent, and it is equally clear that improved radiation methods offer greater possibilities of helping than anything else in view just now.

It is recognized that there are wide individual differences in resistance to cervical cancer, but neither the nature of the normal body defenses nor knowledge as to how to amplify them is at hand.

For the present, the simple conception that radiation is a means of killing cancer cells and that normal cells are more viable under radiation than cancer cells is a good working formula. It is not possible, however, to spray large portions of the body with radiation of an intensity sufficient to kill cancer cells without irreparable injury of essential normal tissues. The prediction is safe that by radiation alone it will never be possible to destroy a generally metastasizing cervical cancer. The problem is to apply a lethal dose to the tissues known to be involved and to those which general knowledge of the disease suggests are likely to be involved, and at the same time to spare all other tissues and regions to the greatest extent possible.

Our advantage over workers of the past in greater knowledge of the physics of radiation, as well as its biological effects, and in fuller clinical and pathological knowledge of cervical cancer, should result in much more rapid and accurate estimation of newer endeavors.

An indispensable preliminary to a critical consideration of the effectiveness of any form of treatment is a grouping of the cases according to the extent of the disease. This does not mean actual extent, but extent as determined by careful questioning and examination of the patient. The real extent is rarely less, but very frequently more, than the clinical findings indicate. Under each group a subgrouping according to histological type is a further step in clarification. The next step is to separate clearly into groups the methods of treatment, and to state in each case the method used and the reasons for doing so. Finally, the cases studied can be classified according to age, complications, or any other grouping that may seem profitable.

No adequate statistics are available today to enable us to answer the query frequently put by a patient or one of her family, "What is the chance of getting well?" The surgeon is under the same obligations as the radiologist. He should be able to show in each case the actual extent and character of the cancer, his technical procedure, his average primary mortality, his percentage of primary cures and five-year cures in each group. Until this is actually done, we can make no real progress in determining the best method to apply to the individual case. A five-year period of freedom from cancer after surgical removal has been taken as indicating permanent cure. This is of course arbitrary. Recurrences after operation do

* Read at the Seventh Annual Meeting of THE AMERICAN RADIUM SOCIETY, St. Louis, Mo., May 22–23, 1922.

take place in the sixth year and may occur at any time as long as the patient lives. I know personally of a thirteenth-year recurrence of a cervical cancer. We must not belittle the importance of four-year, three-year, or two-year cures. If, for example, two methods give in a single class the same percentage of five-year cures, and one a far greater percentage of amelioration and shorter cures

FIG. 1. Group I. Disease limited to the cervix.

FIG. 2. Group II. Disease spreading from the cervix and involving the vaginal wall.

in the ultimate failures, it is clearly a more successful procedure. There is, unfortunately, set by nature a very short limit to human existence, and in the longest life four years is a very material portion.

Our personal position is as follows: Surgical removal in very early cases has a low mortality and morbidity and a very substantial permanent cure rate; in moderate involvement of the parametrium and vaginal walls both the mortality and morbidity are increased and the cure rate decreased; in extensive parametrial involvement or vaginal wall involvement the mortality is definitely increased, the morbidity greatly increased, and the cures are very few; in fixed parametrial masses, in very extensive vaginal, bladder, rectal or in regional gland involvement there are practically no cures.

Radium by local treatment in the early cases has no mortality or morbidity, but a very substantial percentage of permanent cures; in the extensive borderline operable cases the percentage of mortality is low, if anything at all, the percentage of morbidity is low, that of short clinical cures is very high, and that of long clinical cures much less than in early cases, but much greater than by operation. In the extensive parametrial fixations, in involvements of contiguous parts of the bladder and rectum or of all or nearly all the vaginal wall, the percentage of immediate relief is high and may persist for months or years. Clinical cures are very common, but persist for five years in only a small proportion of the cases.

The combination of operative removal and radium topical applications as a preliminary would seem a sound procedure

in the early operable cases. We do not yet definitely know whether this increases permanent cures. We do know that it increases the difficulty of the operation. However, if certain changes are made in operative technique, these difficulties can be largely obviated. Sharp knife dissection must replace blunt dissection, and the best time to operate is five or six days after the radium application.

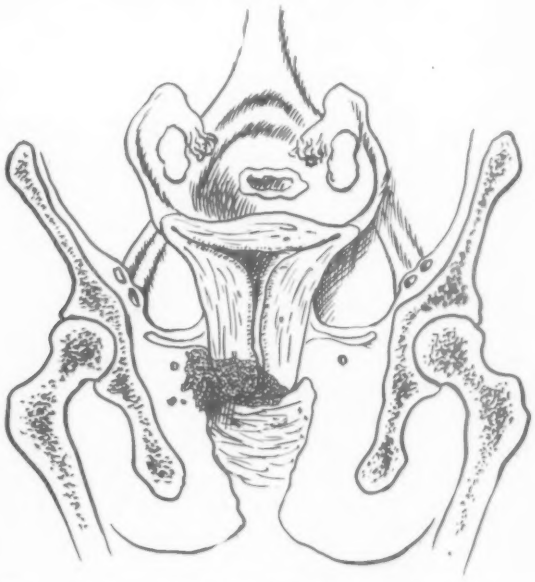

FIG. 3. Group III. Disease slightly involving the parametrium.

FIG. 4. Group IV. Involvement of parametrium with fixation to pelvic wall.

In advanced cases where clinical cure has followed radiation, we feel that operation is probably a mistake, but believe it highly desirable that a long series of these cases be undertaken by very expert surgeons to settle definitely whether, on the average, this is a helpful or a harmful procedure.

We feel quite certain that in the advance to be made in treating large intrapelvic masses by burying radium emanation, abdominal exploratory operations will be a great help. It is also probable that at the time of operation in early operable cases an extension of the operative possibilities can be accomplished by the same means.

Radiation from the surface of the body, abdomen, back, or perineum, has been employed chiefly as a method supplemental to other forms of treatment. We have never used this method alone in treating cervix cases, except those with extensive gland metastases, where marked relief of pain has sometimes been observed, as well as some shrinkage of the masses, but never anything approaching a cure. We have never pushed the method to its limits.

It is highly desirable, in view of the claims from Erlangen, that a series of fairly early cases be treated in this way. If a percentage of primary clinical cures approaching that of the topical application of radium is observed, it will give us very much more confidence in using it alone or in conjunction with other methods in the advanced cases. In this connection, it is easily possible, by using multiple portals on the surface, to give any radium gamma radiation desired in the pelvis. It should be possible, therefore, to compare the effects of gamma radiation through 2 mm. of lead with the *x*-radiation from a 220 kv. apparatus through 1 mm. of copper.

Should actual experience justify the belief in the efficiency of this external radiation, it will undoubtedly be an indispensable adjunct to operative and radium topical methods in treating early cancer of the cervix and bids fair to justify the claims of Wintz and his associates that it should replace all other methods now in use.

CLASSIFICATION OF CASES

A careful history is indispensable. Pain in the pelvis, back, or legs, coming on and associated with bloody vaginal discharge, not only suggests cancer, but indicates an advanced stage of the disease. Sometimes this pain is only brought out on carefully questioning the patient. Recent disturbances of either rectum or bladder are bad omens, as a rule.

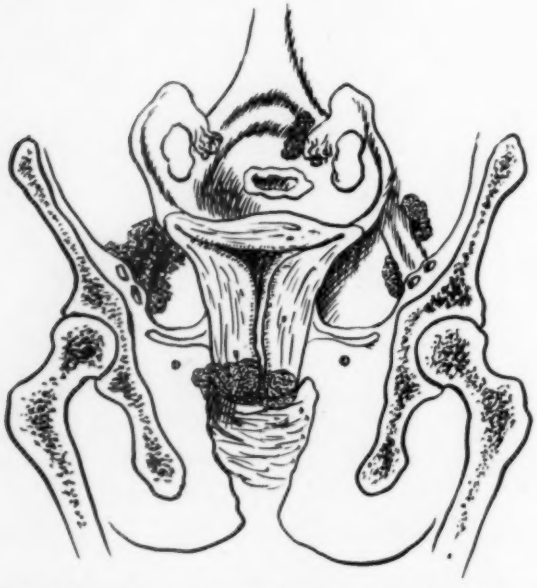

FIG. 5. Group V. Widespread regional gland metastasis

In the general interrogation and examinations, any complicating diseases should be discovered and their relations to any proposed line of treatment considered. Especial attention should be given the blood examinations.

A satisfactory examination of the pelvis can be made in thin patients without anesthesia. In fat ones and in all other cases where necessary, an examination should be made under anesthesia, nitrous oxide preferably. Notes should be made as to the appearance of the cervix, vaginal wall, rectal wall and bladder walls. Bimanual palpation, both abdominal-vaginal and abdominal-rectal, gives the extent of the growth in relation to the pelvic organs, its approximate volume, its distances from the cervical canal, vaginal vault, and abdominal and sacral walls. These measurements should be charted; and in this connection actual drawings or diagrams are most helpful. At the conclusion of the examination, tissue for microscopical study should be taken. On the basis of the examination, a complete plan of treatment should be formulated and the necessary apparatus for the treatment ordered. Usually the treatment is given the day following the examination.

The accompanying diagrams are employed for the purpose of conveniently charting the extent of the disease.

Group I. Early cases confined to the cervix (Fig. 1).

Group II. More advanced cases due to involvement of the vaginal wall (Fig. 2).

Group III. Moderately advanced cases due to involvement of the parametrium (Fig. 3).

Group IV. Extensive involvement of and fixation through the parametrium (Fig. 4).

Group V. Widespread regional gland metastatic condition (Fig. 5).

It is obvious that with such charts any number of groups may be made. An important inoperable group, not shown, is one with the entire vaginal wall involved. It is desirable to have a special diagram for the recurrent cases after hysterectomy.

TECHNIQUE OF TREATMENT

For a number of years we have employed radium emanation instead of radium element. Our applicators are extremely simple. They are shown in Figure 6. The small tube with open cap is 1 mm. thick, made of brass and is the container of the emanation tube. The emanation is usually in a bulb, sometimes in a small tube such as is shown beside the brass tube. When used in cervical cases it is put in a rubber cot with string attached. The clamp is a convenient one for picking up the tube. To the left of the tube is shown a simple cotton cloth applicator in which tubes are placed. These applicators are ordered and arranged to fit the individual case. This is a convenient one for the cervix alone. To the left of this applicator is an elliptical piece of lead about 7.5 mm. in thickness and covered by a piece of gauze. It is used as a screen between the radium and the normal vaginal wall. Sometimes a

number of these can be superimposed and are a great help in obviating proctitis. Above are shown two types of needle carriers. The emanation tube is threaded into the end of the needle. The needle is inserted where it is desired to place the tube, and the tube is then pushed out into the tissue.

In a cancer limited to the cervix, one tube placed at the internal os, one at the external os and four on the cervix, as shown, with a total of 3,000 mc. hours' radiation, divided into 1,200 mc. hours in cervix and 1,800 mc. hours on cervix, is a curative single dose. It is better to give this in a single rather than in broken dos-

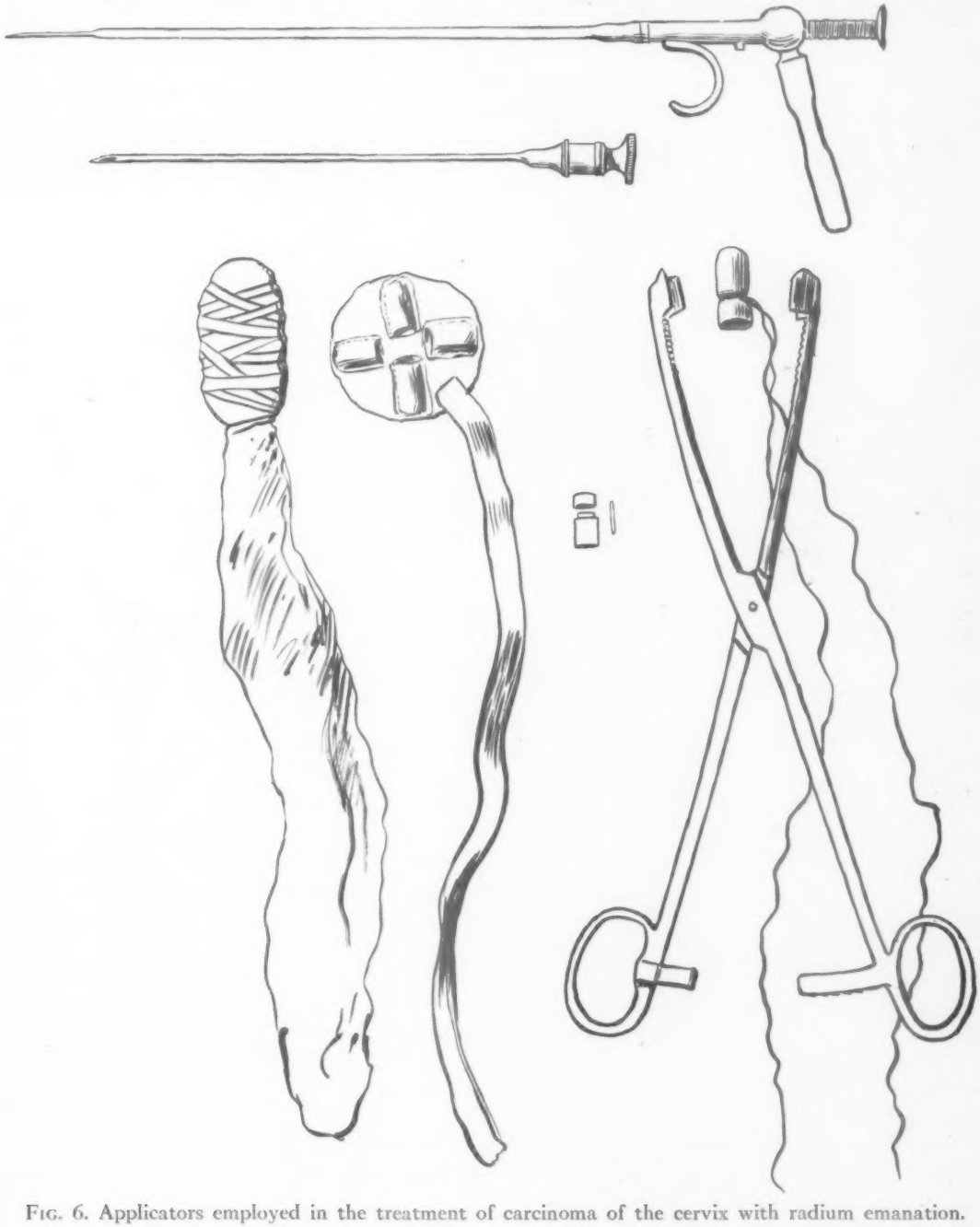

FIG. 6. Applicators employed in the treatment of carcinoma of the cervix with radium emanation.

age. We frequently use 3,000 mc. of emanation in these tubes and complete the radiation in one hour. Where smaller amounts of radium are used and longer times employed, a somewhat greater mc. or mgm. hour treatment is necessary,—perhaps a third more, where 100 mc. or mgm. is the amount of radium or emanation used.

Where the parametria are involved, the exposure should be increased 4 or 4½ gm.

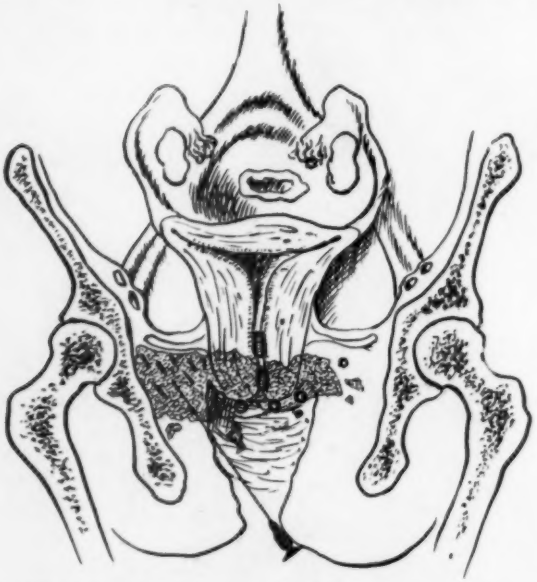

FIG. 7. Cervical cancer with tubes in place. Bare points implanted in deep parametrial involvement.

hours. For extensions on the vaginal wall, about ¾ gm. hour, evenly spread out, should be used for each square 2.5 cm. of surface, in addition to the cervical treatment indicated.

Deep parametrial or paravaginal nodules should be treated by the implantation of emanation points. With a finger in the rectum and thumb in the vagina, the points should be laid in so that each cubic centimeter of tissue gets from .3 to .5 mc. of emanation (Fig. 7).

In high abdominal masses, this implantation should be carried out through an abdominal incision (Fig. 8). It is possible in early recurrences in the parametria immediately after operation to use this technique with much greater precision and safety to surrounding tissues than with the applicators or tubes. The actual strength of the individual tubes in implantations of extensive areas may very likely be still further reduced.

Where the needles are used, the treatment is given under gas anesthesia. Where no needles are used, the normal procedure is to treat in the knee-chest posture, without anesthesia.

After the treatment, examinations are made at intervals of two weeks, and no further treatment given for at least ten

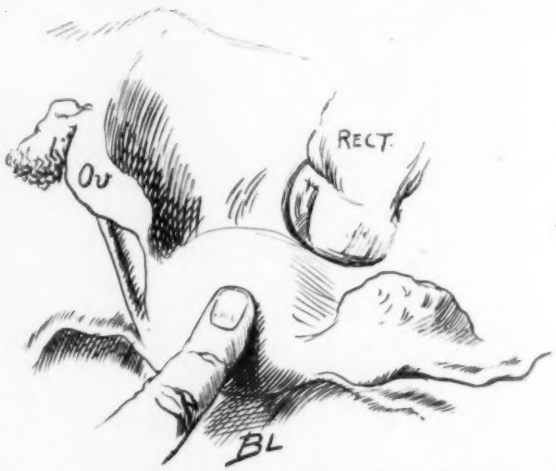

FIG. 8. Appearance from abdomen. Where there is high involvement, this route is necessary.

weeks, unless there is obvious trouble outside of the areas treated. Retreatment in the heavily radiated areas, if given, must be much lighter. As a preliminary to operation, about two-thirds of the above dosage is given.

The primary results in cases treated according to the above plan are very good. Primary clinical cures in all but the advanced inoperable cases are almost invariable. Complications—proctitis, fistulae, sepsis—are much rarer than in our earlier cases. I am uncertain as to whether the permanent cure rate will be greatly increased, but believe it will.

FINAL RESULTS

With Dr. Howard A. Kelly, I collected and reported our results up to Jan. 1, 1915.* In a total of 213 cases there were 14 operable and 199 inoperable. Many of the inoperable cases were huge metastatic cancers. No case was refused. Of the operable cases, 10 were treated by a combination of

* *J. Am. M. Assn.*, Nov. 27, 1915, xlv, 1874–1878.

radium and operation, and 4 by radium alone. Seven were only one year old. All were living and well. Today a review of these cases shows that 5 and 2 survive in each class; that is a 50 per cent cure for over seven years, and the oldest case is eleven years.

Of the 199 inoperable cases, 53 were clinically cured. Of the 53 cases, 42 had been treated within eighteen months. Of these 53 cases, only 15 remain in the cured class. That some of these will ultimately have recurrences is suggested by a comparatively recent case. A patient treated in 1912 for recurrent squamous cell carcinoma of the entire vagina remained well for nine years, to die of iliac gland involvement. At the time of the original treatment this region was clear. There was no local recurrence.

Among the 15 cases left, 2 had circumscribed vaginal recurrences which might have been cured by surgical or cautery removals, but which we have personally never been able to cure. The other 13 were hopeless from the operative standpoint. In 4 of the 13 cases, combined procedures—radium operation and radium—were employed. In 9 of these 13 cases, radium alone was used. In 9 cases there was extensive parametrial involvement and fixation of one or both sides. In 4 cases, the parametria were clear but the entire vaginal wall was involved.

In all these cases the application of the radium was topical. Most of them were treated by repeated broken dosage. The dosage totalled from 2½ to 5 gm. hours.

CONCLUSION

The choice of treatment in early operable cases is, in my opinion, still with operation, with pre- and post-operative radiation; in late operable cases, the choice is with radium topical and perhaps external radiation; in advanced cases, radium topical and implantation of bare points. The use of radium alone in early operable cases is thoroughly justifiable. Operation alone is likewise justifiable. It is highly desirable that all methods be intensively studied today.

DISCUSSION ON PAPER BY DR. GEORGE E. PFAHLER: THE EFFECT OF X-RAYS AND RADIUM ON THE BLOOD AND GENERAL HEALTH OF RADIOLOGISTS*

Dr. Stewart. It was the purpose of the presiding officer as Chairman of the Program Committee to bring the messages of advancement in the past year to this meeting. In order to do so we had to accept communications from men who were unable to be present, especially those who have been making unusual investigations during the past year.

The next paper is one by Dr. Pfahler. We have all looked forward to the results of his investigations. The paper has been published and placed for distribution with the young ladies at the registration desk. I hope you all carefully read it over. The idea is now to devote the time assigned to the matter for pure discussion. Having understood that Dr. Portis had made some investigations along this very line, I am going to ask him to open the discussion on Dr. Pfahler's paper.

Dr. Portis. I am sure we all regret Dr. Pfahler's absence from this meeting. If he were here to present in his own pleasing and forceful manner the communication which I hope you have all read, it would carry greater weight, and, in addition, his presence at the meeting would be very desirable. It was my opportunity and privilege to read the manuscript which was sent to me, and I believe that his paper is the most complete and the most thorough of any communication on this subject today. He has gone into the entire literature very carefully and presents his own observations and studies. With some of this I agree, and with some I disagree.

I have been very much interested in the protection of the *x*-ray worker ever since my interest in roentgen-ray work. A number of years ago I stirred up a hornet's nest among friends who are working with *x*-ray, and attempted to carry on a rather extensive study, but did not meet with any success. The man who is washing windows on the 14th story knows his job is dangerous, but does not want to be told it is. We all get accustomed to the

*This paper appeared in the October number of the Journal.

dangers about us, and pay comparatively little attention to them, and that is possibly a good thing, for we are here to get as much joy out of life as possible, and not be worried every minute. I wish right here to say that I hope you will not consider me an alarmist by the statements I shall make today. Quite the contrary. Surface burns and other changes have brought me to see the danger of the thing we are attempting to do. Today very few men—probably none—burn or have the other changes that we saw in the unfortunate early workers, who, largely through ignorance, were exposed.

There is a real danger to the man engaged in radium and *x*-ray work, and I am sorry to add this statement that even today the majority of us are not taking proper precautions in having ample protection.

When I was actively interested in this work, it was particularly in the fluoroscopic room that I carried out my investigations; and I was surprised to find that a machine sent me by a very good manufactures not only did not protect me against the primary ray, but absolutely no consideration was given to the secondary ray.

Prof. Milliken, of the University of Chicago at that time was kind enough to suggest to me various ways of protection, and we modified the fluoroscopic machine until it was comparatively safe. I studied the blood of all the men whose blood I could get a sample of, and then attempted in one of our large institutions where a great many people are employed, to get some further studies; but the man at the head said he was afraid to carry out the careful blood examinations because he was afraid that those engaged at this particular place would become fearful of their occupation and he would not be able to get helpers. That does not mean that the danger is not present and that damage is not going on, whether or not we ignore that side of the question.

Some studies which we made in 1915 I summarized as follows: There has not been a uniform blood picture. Studies were made in individuals who thought they were well, but who were engaged in *x*-ray work to a greater or lesser degree. The majority show a diminution of the total number of leukocytes, which, in some cases, has been progressive. The lymphocytes were commonly relatively increased, and at times this was the most pronounced finding. Closer examination of the lymphocytes showed abnormal varieties described by some as unripe forms, and by others as irritation forms. Myelocytes were found in three of the cases in small numbers. The red blood corpuscles were not affected and the hemoglobin only slightly reduced.

Those observations I have confirmed from time to time in the past seven or eight years, but I am sorry to say that I have not had the opportunity to make the study which, to my mind, would be the conclusive one. We should make observations on a great many people who contemplate taking up *x*-ray work or radium work—physicians and others. We should make studies of their blood from time to time after they are engaged in the work. We should, in all of these cases, and probably correctly so, ask them all to carry out the dental film idea which Dr. Pfahler recommends in his paper, to see whether or not there is any evidence of change. That there is or is not should be a measure of the amount of exposure the individual is getting in his so-called protective atmosphere. Then, after these studies have been made on a great number of individuals, before they have engaged themselves in the work and after they have been in the work, we will be privileged to draw more rational conclusions. There is no doubt that a great many individuals without proper protection will show some changes, and if this is so, then we must admit that the number of deaths reported among *x*-ray workers, due to various types of blood change, especially so-called aplastic anemia, etc., include a certain proportion due to *x*-ray exposure. Not all, for these blood disorders occur in individuals who have not had any relation directly or indirectly with *x*-ray work. It can only be said that it is a factor in the production of these disorders.

I hope you feel that I do not consider the danger to the *x*-ray worker a maximum one and even not a definite one. There seems to be individual variation of susceptibility to the effect of *x*-rays. Some who are exposed a great deal show comparatively little change, while others with a minimum amount of exposure show definite change. That is a factor that we simply cannot explain, any more than we can so many other questions of susceptibility to different drugs and different pathological stimuli; but it seems to me that if we are to take the proper precautions for ourselves and our posterity, if we are interested in the development of *x*-ray and radium work, if we are to see it come into its own, then there is every reason why the manufacturer and we ourselves should combine in getting the maximum protection. This is particularly necessary with the advent of the new high-voltage machines.

We have two such machines at St. Luke's Hospital; and before the machines were used at

all an enormous amount of protection was put in various ways about the machines. The superintendent of the hospital has been very kind and very much interested in the question of protection. It was he who devised my apparatus seven years ago which I have been using since, and which I think is the only one which protects me from the secondary ray in the proper manner. He himself is a man who understands the problems of physics and has had special training along those lines. I will not go into the manner of protection, but simply say that they put what looked like a foolish amount of protection around these machines. Then Dr. Jenkinson put films in various places and carried some; and we were utterly astonished at the changes the dental films showed. I should say that an electroscope would be far more accurate, but for clinical purposes, as Dr. Pfahler points out, the dental film is enough. It is the simplest thing we can do. Dr. Jenkinson himself expects to publish his observations. I cannot give the details, but I know that when I left Chicago two months ago, they did not feel secure as yet, after adding and adding protection, and yet the protection is so much more than I have seen at any other place in the country.

I was at the St. Louis meeting of the Radiological Society, and while there we visited a large hospital. The man in charge was very well informed on the subject. We asked about the question of his protection and he showed what he had. We immediately told him it was far from adequate.

We have the cooperation of splendid physicists in this country. A great many men are in position to help us scientifically in the matter; and I think it is our duty, whether or not we care about our own personal protection, to see to it that we do protect ourselves and those working with us, in a complete manner, against this insidious foe, which is lurking constantly about, and which in the end will bring destruction.

Dr. Case. I am very much interested in Dr. Pfahler's paper. I have been very much interested in this subject myself. At one time there was a meeting of the American Electrotherapeutic Association in our town, and a number of the men of the society had done considerable *x*-ray work—most of them with less protection than the average man here. I failed to find any significant changes in the blood-counts, and so I did not publish the evidences at that time.

With the amount of protection now afforded in the average laboratory of the men who are members of this society, the amount of danger from exposure is far less than the danger of close confinement associated with lack of exercise and long hours to which the *x*-ray men are subjected. I believe we can correct some of those things in the manner suggested by Dr. Pfahler.

I was much interested in a report of the Radium Co. stating that the health of the employes was unusually good, and the number of hours absent from work was less than the average in other factories. I assume that with deep therapy we will step to a field we have not yet covered. I heard some talk about deep therapy machines not being allowed in certain buildings unless they were in a corner room. I have had an *x*-ray tube pointed obliquely toward the room of my office for nearly two years, and I had a camera loaded with moving picture films on my desk—second wall beyond —without any lead on any of the walls, for two weeks and they made perfectly fine exposures.

I believe we should be perfectly rational about the questions of protection and be governed by electroscope measurements and not be afraid.

Although radiologists have proven in the past to be poor risks by life insurance companies, and perhaps ten or twenty men have lost their lives as a result of their calling, nevertheless thousands of lives have been saved through *x*-ray work.

Dr. Ullman. Dr. Pfahler's paper covers the question so thoroughly from the roentgenological standpoint that it leaves very little to say. There is one point that impressed me strongly, especially with our present work in deep therapy; that is, the lymphocytic and leucocytic reaction is not as important as some workers would lead us to believe. The red count is the more important. In doing some other work on rabbits we found no changes. Gastric ulcers would in some cases send the lymphocytes down and in others up. We did not do anything on the red count in those cases.

I had an opportunity to test the coagulation time. We were raying rabbits with the ordinary type tube stand at 120,000 volts, 5 ma. and the usual lead glass bowl. The machine stood in an ordinary room, and I was in a room about 30 ft. away with two walls in between. I had one exposure of one hour and the next night another hour. The following day I took my coagulation time; it was less than thirty seconds and it took seven days to come back to normal. These same rabbits just before death showed that the blood clotted very quickly.

I made some observations immediately following heavy radiation, on the leucocytic and lymphocytic reactions, and saw nothing very important. You get an immediate rise and fall to normal.

The question of protection—I think many of us and many manufacturers look at it from the wrong angle. We have inclosed both tube and machine with lead, also the floor, ceiling and sides. I think you will find that where there is not enough protection and you get fogging through 8 lb. lead, you have some wood exposed somewhere which is carrying secondary radiation around the corner. It does not require so much lead to cover everything.

DR. LEWALD. I would just like to call attention to a circumstance which has arisen in New York which may be of considerable help in determining the question of protection. The fact is this: The Commissioner of Health, City of New York, had an ordinance passed requiring a license to be issued to every *x*-ray laboratory operating within the city limits. That is an ordinance that will require considerable alteration in order to carry out the points in regard to protection.

I talked to Dr. P. about this, and while he had certain suggestions to offer, he had no set of regulations that he would say could be definitely enforced.

One point which Dr. Portis brought out is as far as we have gotten in actually enforcing one regulation, and that is, a filter must be put in every apparatus. We were surprised that a large number of machines, particularly the fluoroscope, were put out without any filter. A number of dental machines are without filter.

At the present time in New York City no license is issued without the inspector finding that a filter is in constant use in every laboratory. There are a number of interesting sidelights on this. For example, what constitutes an *x*-ray laboratory? Men who were using the fluoroscope alone said they did not have an *x*-ray laboratory, but the Health Department ruled that to use an *x*-ray machine on a human being constituted one, and that the amount of work done or the size of the laboratory had nothing to do with it.

The question also came up as to whether a physician was entitled to a license simply by having his medical license. Also the question of technicians—as to whether the making of radiographs was a medical act. These are points that have to be determined also. There seems to be some opinion among local men who have taken up this problem as to whether it is not a question of practice of medicine and the mere taking of radiographs without interpretation. The Commissioner of Education has taken that stand, but others who have been advised in this regard said that their operation of *x*-ray machine on the human subject is administration of a powerful agent, which is the same as the administration of drugs, and is therefore practicing medicine.

I was glad to hear what Dr. Ullman said about proper distribution of lead and its proper use. We have not been able to decide upon the minimum amount of lead.

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Information of interest to all readers and lists of officers of The American Roentgen Ray Society and The American Radium Society will be found on the two pages preceding Table of Contents.

THE TWENTY-THIRD ANNUAL MEETING

The Los Angeles meeting has passed into history, but it will be remembered long by those who enjoyed the privileges of the excellent scientific program and the unique social entertainments.

The attendance, while smaller than anticipated because of the strike disturbance, was fairly representative. About 25 per cent of the total membership of the society were registered. Familiar faces from the East and Middle West were missed, and their absence gave a false impression of small attendance; however, the Western Section, whose meeting this really was, attended almost to a man. Visiting physicians numbered 164, non-medical visitors, 22, ladies, 67 and exhibitors 35. The annual dinner was well attended.

The program was exceedingly full and, at first sight, it did not seem possible that it could be handled in four days. However, Dr. Stewart had studied the matter thoroughly, and had carefully arranged every feature of the program, so that the papers and discussions moved with clock-work precision. An unusual and highly appreciated feature was the presentation, in printed form, of the papers read by title, together with the showing of their illustrations in the scientific exhibits. Those attending were thus able to read the papers of invited guests from foreign countries, most of whom were unable to attend in person. The time allotted on the program to such papers, was then given over to discussions of the respective subjects considered.

The Caldwell Lecture by Professor Duane, of Harvard University, was attended by quite a number of local physicians, and his clear, logical presentation of some of the problems and effects of short wave-length rays was greatly enjoyed.

The scientific exhibits were the most comprehensive and elaborate ever shown before the society, requiring the construction of twenty-five extra lighting racks, in addition to the light boxes shipped to Los Angeles. The exhibits were all in place before the scientific sessions started on Tuesday morning.

The commercial exhibits comfortably filled the large banquet room of the Ambassador, featuring high-voltage therapy apparatus and accessories.

The social entertainments were unique, beginning with a preliminary dinner tendered the visitors and members by the Pacific Coast Roentgen Ray Society, at the Wiltshire Country Club, on Monday evening.

On Tuesday, the ladies were entertained at lunch by Mrs. Soiland, visiting the Busch Sunken Gardens, in Pasadena, in the afternoon. On Tuesday evening, the "Forty Niners' Camp" entertainment was held at the Ambassador. Albert Soiland gave an exhibition which showed an unholy familiarity with a supposedly dead art, while Bowman and Bonoff marshalled other devices in a manner which explained their opulence in a profession not noted for its millionaires.

Thursday evening was the occasion of the President's dinner; the arrangements were informal, including dancing and a movie comedy shown for the first time in honor of the occasion.

On Friday evening, the ladies and the men were taken in different directions, the former being entertained in small theater

groups, while a stag party in Hollywood attracted most of the men. This party is reported by those who were able to recall the details as being beyond powers of description.

The closing feature of the session was the trip to Catalina on Saturday and Sunday. All members and guests were driven by auto to Wilmington, and served with lunch at the Yacht Club, after which they boarded steam yachts, loaned by members of the Club, and sailed to Catalina. After dinner at the St. Catherine Hotel, the "Flying Fish" boat trip about the island was taken, the feature of this being the illumination of "flocks" of flying fish by search lights. Sunday morning, a second trip was enjoyed, this time in the glass-bottom boats to the Marine Gardens, after which the party boarded the yachts and were brought back to Los Angeles Harbor.

The first Western meeting was a notable success, and it will not be difficult to enlist the enthusiastic support of the members attending, when the logical time comes for another meeting on the Pacific Coast.

The officers elected for the ensuing year were:

President-Elect: Dr. Hollis E. Potter, Chicago, Ill.

First Vice-President: Dr. John Edmonson, Birmingham, Ala.

Second Vice-President: Dr. Chas. L. Martin, Dallas, Texas.

Secretary: Dr. W. Warner Watkins, Phoenix, Ariz.

Treasurer: Dr. Wm. A. Evans, Detroit, Mich.

Librarian: H. W. Dachtler, Toledo, O.

Member of Executive Council: Dr. A. H. Pirie, Montreal, Can.

The Executive Council selected Chicago as the place for the 1923 meeting, the time to be in September.

W. WARNER WATKINS, Secretary.

EASTERN SECTION

FOURTH ANNUAL MEETING

The Fourth Annual Meeting of the Eastern Section of The American Roentgen Ray Society will be held in Atlantic City, at the Ritz-Carlton Hotel, on January 25th, 26th and 27th. It is contemplated to follow the precedent of last year in adding another day to the meeting. The first session will be held on Thursday evening at 8 o'clock. This is to be followed by morning, afternoon and night sessions on Friday, and morning and afternoon sessions on Saturday. There will be no meeting on Saturday night. The management of the Ritz-Carlton offer the following rates:

European plan:

Single room with bath, $5.00 daily, one person.

Double room with bath, $7.00 daily, two persons.

With meals:

Single room with bath and meals, consisting of club breakfast, table d'hote luncheon and dinner, one person, $10.00 daily.

Double room with bath and meals, consisting of club breakfast, table d'hote luncheon and dinner, two persons, $18.00 daily.

There will be a commercial exhibit, and those desiring space, who have not been notified by the President, can obtain same by communicating with him. It is to be hoped that the lantern slide exhibit will prove the same interesting feature of the program as in recent years, and it is earnestly hoped that more will take an active interest in this part of the program. Those desiring to show lantern slides please communicate with the President. The officers of the Eastern Section of the American Roentgen Ray Society are:

President:	C. A. Waters, 1100 N. Charles Street, Baltimore, Md.
Vice-President:	Thomas A. Groover, 1621 Connecticut Ave., N. W., Washington, D. C.
Secretary:	Charles Eastmond, 483 Washington Ave., Brooklyn, N. Y."

DR. HERBERT THRELKELD-EDWARDS

Dr. Herbert Threlkeld-Edwards died at his home on Delaware Avenue, Bethlehem, Pa., on the afternoon of September 30th, after an illness of one and a half years.

Dr. Edwards was born at Esher, Surrey, England, on March 30, 1870. He studied under tutors in England, also attending Surrey House, and at the age of sixteen years accompanied his father, George Clayton Edwards, to this country.

He studied at the University of Southern California, and subsequently enrolled in

HERBERT THRELKELD-EDWARDS, M.D.

the medical department of the University of Pennsylvania, where he was graduated in the class of 1892.

After serving his internship at St. Luke's Hospital, this city, Dr. Edwards became demonstrator of pathology at the University of Pennsylvania, remaining as a member of the faculty for two years.

He then returned to Bethlehem, where he engaged in extensive professional endeavor for many years. Notwithstanding the heavy responsibilities incident to his practice, Dr. Edwards retained his habits of study and scientific research, and developed the first American Intensifying Screen. Of recent years he was actively engaged in the manufacture of this screen.

He devoted special study to roentgenology, in which he was a pioneer in this section. Under his direction the modern x-ray laboratory at St. Luke's Hospital was founded, and he was the first director there.

The advance of medicine and surgery under the pressure of war conditions was a subject which Dr. Edwards studied carefully, at the same time giving prodigally of his time and labor toward the devoted effort that achieved this advance in the hospitals and laboratories at home and abroad. Dr. Edwards' Intensifying Screen was widely used by the American Expeditionary Forces in France.

Dr. Edwards was a member of the national, state, and country medical associations, the American Roentgen Ray Society, the Philadelphia Roentgen Ray Society, the Philadelphia Medical Club, the Alpha Mu Pi Omega Medical Fraternity, the Country Club of Northampton County, and the Baucon Valley Country Club.

He is survived by his wife, his daughter, Mrs. Gerald Thorp, and his grand-daughter Elizabeth T. Thorp of Bethlehem, his son, Herbert Threlkeld-Edwards, Jr., of the University of Pennsylvania, and three brothers in Southern California.

CORRESPONDENCE

To the Editor:

Anyone who has recently been to Vienna must have been deeply affected by the deplorable state of affairs, particularly among our colleagues, the roentgenologists. Their hospital laboratories lack equipment and their research work is made exceedingly difficult by lack of means and necessary apparatus. Nevertheless, they are trying bravely to carry on under these most trying and difficult circumstances.

It occurred to me that the American roentgenologists, particularly those who have enjoyed the courtesies of our Austrian colleagues, can do a great deal toward helping some of the workers to obtain the necessary equipment in the hospitals. My appeal concerns particularly Doctor

Haudek's hospital laboratory in the Elizabeth Hospital. As small a sum as $500.00 will enable him to buy a fluoroscopic apparatus.

I beg to enclose my check for $50.00 as a starter for this fund, and hope you will be able to obtain the full amount and forward it to him with the compliments of the American roentgenologists.

Very respectfully yours,

I. S. HIRSCH.

New York City,
October 20, 1922.

THE LEONARD PRIZE

The American Roentgen Ray Society is again offering the Leonard Prize in 1923, details for which appear on advertising page ix of this number of the Journal. The manuscripts submitted for the 1921 prize were of a high order of merit and covered a variety of subjects pertinent to roentgenology. It is to be hoped that the contestants for the next prize will be equally zealous in their efforts.

BOOK REVIEW

DIE RÖNTGENDIAGNOSTIK DER MAGEN- UND DARMKRANKHEITEN. By Emmo Schlesinger. Contains 402 pages, 228 illustrations and 8 tables. Second, revised edition. Urban and Schwarzenburg, Berlin, 1922.

In his introduction, Schlesinger argues ably in support of the conventional Continental view that the roentgenologic examination of the digestive tract should be regarded simply as an adjuvant of the clinical examination. He points out that even under the most favorable circumstances the *x*-ray can only present a faithful delineation of the lumen of the stomach and intestine—a relief of their internal surface—together with their movements and changes of position. It may show a defect, but whether this indicates a cancer, an artifact, extraventricular compression, a contraction, or adhesions, can be determined only by exhaustive investigation, partly roentgenologic and partly by other methods.

Although Schlesinger thus adheres in principle to correlated diagnosis, his book, nevertheless, more nearly approximates American texts than do most European publications. True, he describes indirect signs and the "small change" of diagnosis quite fully, but the still more important "direct" signs are given due emphasis. It is not a clinical, but a roentgenologic, text, and his confidence in the *x*-ray is evident.

Schlesinger considers both roentgenoscopy and roentgenography indispensable. Because of an *x*-ray burn he has recently been unable to use the screen, and, although he has endeavored to compensate for this by making eight or ten plates, he confesses that he has not the same feeling of certainty that he had when using the screen.

While Schlesinger was one of the pioneers in gastric roentgenology, he is not inclined to be dogmatic or contentious. Modesty and fairness are shown by his abundant references to the work of his colleagues in roentgenology, and by an exhaustive bibliography in which American writers are well represented.

Drawings illustrate the text, but these are well done, and are perhaps even more instructive than reproductions of roentgenograms would be. A few tables of roentgenographic prints are appended.

Criticisms might be offered and opposing views occasionally advanced by the reviewer, but these would seem captious and trivial in view of the general excellence of the book, which is one that every roentgenologist should have in his library.

R. D. CARMAN, M.D.

Subscribers to THE AMERICAN JOURNAL OF ROENTGENOLOGY *visiting New York City, are invited to make the office of* THE JOURNAL (*69 East 59th Street, New York*) *their headquarters. Mail, packages or baggage may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; in this case, kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

TRANSLATIONS & ABSTRACTS

Radiology in Montevideo. The annual report of the Instituto de Radiologia for 1920 appears in the *Anales de la Faculta de Medicina* of the University of Montevideo, v, 584.

The objects of this institution are to teach radiography, to aid in the diagnosis and treatment of disease, and to conduct scientific investigations. Two courses of instruction are given annually. There is no mention of the number and personnel of the students. The total number of patients seen for the year was 5,647. The total number of patients treated during the seven years was 25,853. The budget for the expired year was $9,252. The subjects which were investigated during the year were tracheobronchial adenopathy, diagnostic radiology of pulmonary tuberculosis, new congenital anomalies of bone, pneumoperitoneum, a new method of pyelography, medico-legal determination of age in the living, and treatment of varicose ulcers and of prostatic hypertrophy by radium. The affections treated during the year comprise miscellaneous cutaneous and gynecological lesions in the following order of frequency: Cancer, eczema, leucoplasia, fibroma of the uterus, exophthalmic goiter, tuberculous adenitis, angioma, nevus, lupus, etc. There has been a great increase in the number of precancerous conditions treated, including cutaneous keratosis, leucoplasia, papilloma, nevus and the initial stage of cancer itself. The Institution needs to be enlarged with especial reference to new departments of activity. Evidently the treatment of deep-seated cancers throughout the body and the location and removal of projectiles have thus far been deficient for lack of proper installation. The report is signed by Director C. Butler.

Pendergrass, E. P. and Pancoast, H. K. The Close Relationship of the Erythrogenetic and Leukogenetic Functions of the Bone Marrow in Disease. Report of a Case of Erythremia. The Roentgen-ray Treatment of Erythremia. (*Am. J. M. Sc.*, June, 1922, clxiii, No. 6, 797.)

Attention is called to the close relationship of diseases affecting the red and white blood corpuscles. Several instances are cited from the literature where conditions previously diagnosed leukemia were finally determined to be erythremia; and vice versa, conditions previously showing erythremia traits were ultimately determined to be leukemic in character. Conclusion is drawn that the erythrogenetic and leukogenetic functions of the bone-marrow are closely related.

A case is reported, giving the entire history, clinical findings and blood-counts in detail over a long period, in which very nearly the same picture is presented as those quoted from several different authors. With the assumption that the red and white blood-corpuscle-forming functions of the bone-marrow were closely related and that the spleen was the "graveyard of the red corpuscle," treatment was instituted, giving a complete course of inhibiting doses over the bones of the body, and a smaller, presumably stimulating, dose over the enlarged spleen itself.

As a guide in the treatment the following facts must be borne in mind:

1. The spleen is more sensitive to the roentgen rays than is the bone-marrow.
2. After moderate doses of the roentgen rays the leukocytes show an initial rise followed by a pronounced and subsequent rise to normal.
3. The red cells show an initial fall after moderate doses of the roentgen rays. This may last for long periods of time, or the cells may rise to normal in the course of a few days.

As to the ultimate success of the roentgen-ray therapy of erythremia, one must wait and see the results of the treatment of various cases and the observation of such cases over a number of years. However, roentgen-ray treatment is only an agent recommended in an effort to find something that will give relief to this class of patients where drugs are of no avail, and venesection, etc., only of initial improvement, the patient relapsing into the primary state in a comparatively short time.

If we accept the views of a number of pathologists, and assume that the disease is one primarily of the bone marrow and the lesion is a primary hyperplasia of the erythroblastic tissues, our treatment should be that of the bone-marrow, with the view of inhibiting the excessive formation of red cells; or if all cases of erythremia are secondary to some exciting cause foreign to all bone-marrow, as considered by some, roentgen-ray therapy is recommended in those cases in which no primary cause can be found and which have failed to respond to the usual method of treatment.

The treatment of the spleen is given with the view of stimulating the functions of that organ. There is some histological evidence that the spleen destroys erythrocytes by the phagocytic action of the cells of the spleen. The spleen is very susceptible to the action of

the roentgen ray; hence we must make exposure a stimulative one. There is no experimental evidence to support the assumption that stimulative doses of roentgen rays over the spleen increase the hemolytic action of this organ, although a number of men have worked on this particular subject. However, we feel that theoretically the function should be increased, and we are therefore working on that basis.

The details of the technique are very similar to the treatment followed out in the treatment of leukemia recommended by Stengel and Pancoast which have been outlined in a previous paper.

CONCLUSIONS

1. Erythremia is a disease of the erythroblastic tissues of the bone-marrow.

2. Roentgen rays destroy or inhibit the formation of red cells.

3. Roentgen rays should be used in the treatment of erythremia.

4. Roentgen rays should be used in the treatment of secondary polycythemia when such cases fail to respond to other treatment, such as drugs, venesection, etc.

5. Roentgen-ray treatment has been efficacious in the case reported above, and it has proved of value in cases reported by other roentgenologists.

6. Roentgen-ray therapy effects more permanent results than any other therapeutic measure used or recommended up to the present time.

L. R. S.

MATSON, RALPH C. Diaphragm Irregularities. (*Am. J.M. Sc.*, June, 1922, clxiii, No. 6, 826.)

In a study of 3,754 chest cases, 4 per cent showed diaphragmatic irregularities. Heretofore, irregularities of the diaphragm having a tented appearance have been thought to be due to pleuro-diaphragmatic adhesion. However, in checking up examinations made at various times on the same cases, some observations were made which were inconsistent with the assumption that tenting of the diaphragm necessarily meant pleurodiaphragmatic adhesions. To determine whether or not these irregularities actually represent adhesions, many cases were studied, some having been normal before influenza pneumonia, and showing this tenting after the disease. To determine whether or not these were adhesions, a pneumothorax needle was inserted. As the air flowed in, the irregularity of the diaphragm disappeared, being entirely absent after introduction of 250 c.c. of air, a quantity so small that it could scarcely be detected in the roentgenogram. As the air absorbed, the tenting reappeared, being well established in ten days. The principles concerned in the production of a lung dimple, upon which diaphragm irregularities of the pseudo-adhesion type depend, were tested out experimentally. A bell jar was fitted with an inlet and an outlet at the top. A pair of sheep's lungs were inflated by exhausting the air surrounding the pair of lungs in the bell jar, a piece of stiff wire with a barb on the end being inserted into the lower bronchus to represent the rigid bronchus encountered in diseased condition. As the lungs expanded, a dimple formed on the under surface of the lung. From these experiments the following conclusions were drawn:

1. The assumption that tenting of the diaphragm always diagnoses pleurodiaphragmatic adhesions is unjustifiable.

2. Tenting of the diaphragm, frequently seen on plate and screen at the termination of the hili-diaphragm superfices, with characteristics which are associated with pseudo-adhesions, is a purely physical phenomenon brought about by two factors: (*a*) During inspiration the diminished elasticity or rigidity of the lower bronchial branches prevents descent of that area of the lung base in immediate relationship to the bronchus involved; thus a dimple effect is produced on the surface of the base of the lung. (*b*) The diaphragm being molded to the base of the lung by a negative intrathoracic pressure is held by suction in the dimple above referred to, producing a tented appearance (pseudo-adhesion).

3. Diaphragm irregularities of the pseudo-adhesion type are commonly found during the course of acute and chronic respiratory infections. In acute respiratory infections with peribronchial infiltration involving the lower bronchial branches, the irregularity disappears with restitutio ad integrum. In chronic respiratory infections with consequent connective tissue, proliferation appears to be permanent in nature.

4. It is reasonable to suppose that should infiltrative or proliferative changes incident to infection not halt at a point in the bronchial tree proximal to its termination, but instead, proceed to the pleura, then the diaphragm would become adherent and the pseudo-adhesion would be converted into a tree adhesion.

It is hoped that this contribution will excite interest and further study of the subject.

L. R. S.